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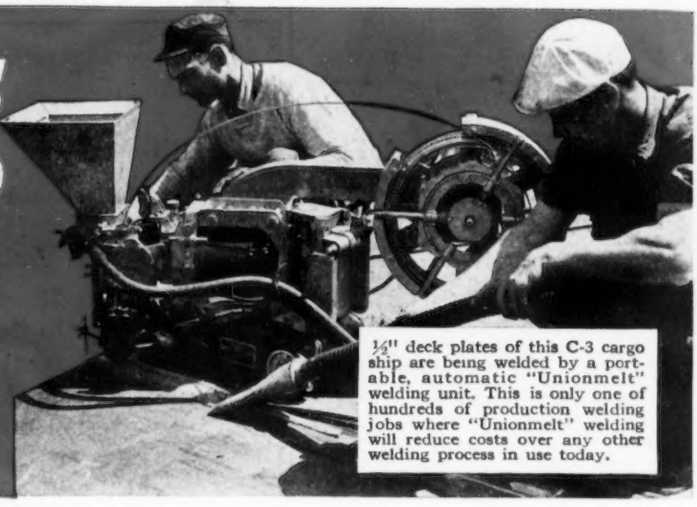

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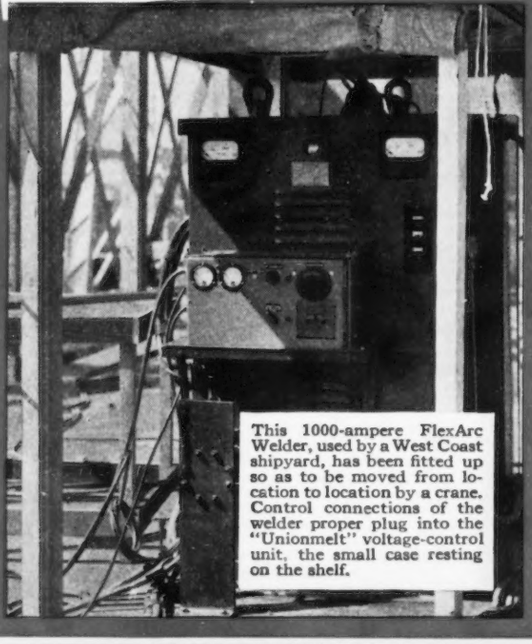

This 1000-ampere FlexArc Welder, used by a West Coast shipyard, has been fitted up so as to be moved from location to location by a crane. Control connections of the welder proper plug into the "Unionmelt" voltage-control unit, the small case resting on the shelf.

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*The word "Unionmelt" is a registered trade mark of The Linde Air Products Company.

J-70278

Westinghouse Flexarc Welders

WESTINGHOUSE ELECTRIC

The Iron Age

OCT. 31, 1940

ESTABLISHED 1855

Patriotism and Tomatoes

THIS is the last in the series of "non-political" editorials that have been appearing in The Iron Age for the past several weeks, advocating the election of Wendell Willkie. It is the last because there isn't time for any more before election.

Some of our readers have called these editorials "non-political" and have liked them. Occasionally we hear from some one who calls them "political" and dislikes them enough to cancel his subscription.

Now we do not care whether you call them political or not, but neither do we care whether there is a good Democrat or a good Republican in the White House. Our country has survived and prospered under both kinds, and could continue to do so. But it cannot and business cannot survive four more years of a hybrid Administration headed by a rabble rouser who has led American citizens to express their preference for President with missiles instead of ballots.

Stop and ask yourself why Wendell Willkie, a nominee of a great political party for a great office, has been subjected, in many parts of this supposedly free country, to assault and indignities when he has appeared to present his cause to the public.

Dictators stay in power through the force of armed minorities of mercenaries. Bullets instead of ballots. Are we far from this in America today when we see a contending candidate stoned?

Was it anything that Mr. Willkie had done or said that invited or excused this disgusting exhibition? No, for his campaign has been kept upon an exceptionally high level. He has not thrown stones at those who disagreed with him.

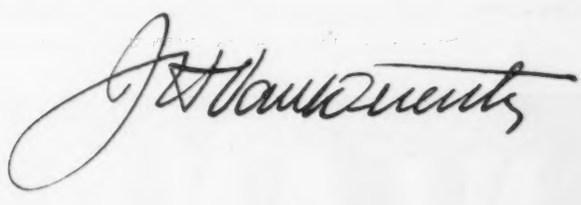
Were these exhibitions of moronism caused by deep feelings on political issues such as getting into war or staying out of it; getting into debt or climbing out of it? Or were they simply evidence of a decadence of the American standard of manners and morals since the advent of the New Deal and its adjective slinging Ickes?

Unfortunately it was none of these things. If it were we could laugh these indignities off and forget them. But they go far deeper than this.

These disgusting incidents were bubbles from the hell-broth pot of hate that has been brewing in Washington ever since the New Deal took power The pot is now boiling over and spilling the scum on decent men and women.

The hell-broth pot of class hatred. Fanned by the Big Wind from Washington. Brewed with sonorous incantations from the fireside. And ladled out to a credulous public by crooked politicians who hold their noses.

Birds of a feather, so they say, flock together. The decent men and women of America, Democrats and Republicans alike, will not flock with these vultures. They will let Mr. Roosevelt have those birds and they themselves will vote for Wendell Willkie.



Tarring Molds—A Routine Step at Inland

A VISITOR to the Inland Mills, observing the various stages in the making and processing of any product, will immediately be impressed by the thoroughness of attention to detail. He will learn that not the slightest factor, which will contribute to Inland quality and uniformity, is neglected.

For example, consider production of a heavy tonnage product such as plates. From mines and quarries to open hearth furnaces, raw materials are under perfect control. Carefully engineered furnaces are equipped with the latest types of control instruments, and open hearth practice has been standardized, resulting in heat-to-heat uniformity.

Inland molds are tarred to prevent ingot scabs. From the time the ingot is cast, surface and interior inspection is maintained on ingots, slabs, and the final plate product to eliminate any possible surface or internal defects. Surface defects on slabs are marked, and removed by chipping or scarfing before rolling into plate.

Combustion and temperature are under close control in the ingot soaking pits, and ingots are reduced at speeds regulated to assure correct rolling temperatures.

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Pure Iron-Phosphorus Alloys

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THIS is a study of the effect of phosphorus alone on pure iron. Data are given as to the testing procedure, and results are set down as regards impact, hardness, machinability, carburizing characteristics, etc.

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By GEORGE T. MOTOK

General Metallurgical Research, Republic Steel Corp., Massillon, Ohio

THE text-book classification of phosphorus as one of the "nuisance elements" present in steel can no longer be unreservedly accepted. On the contrary, it is now being recognized that the presence of phosphorus, particularly in mild and low alloy steels, serves a useful purpose by strengthening the steel and increasing its resistance to atmospheric and other corrosive actions.

The prejudice existing against phosphorus has been based largely on its reputation as an embrittling impurity —the general observation that phosphorus in solution makes for brittleness in commercial iron and steel under impact—and the belief that it likewise tends to segregate in a harmful way.

For example, heating Bessemer steel (which contains about 0.1 per cent phosphorus) to 450 deg. C., as in galvanizing, may cause a drop in the impact value. If cold working precedes the heating, very decided brittleness may result. Malleable iron containing about 0.13 per cent phosphorus ordinarily has good ductility, but after galvanizing may become brittle. On the other hand, if the malleable contains less than 0.1 per cent phosphorus, it is not likely to become brittle even in galvanizing.

The constitutional diagram for the iron-phosphorus alloys has been studied in detail by many investigators.

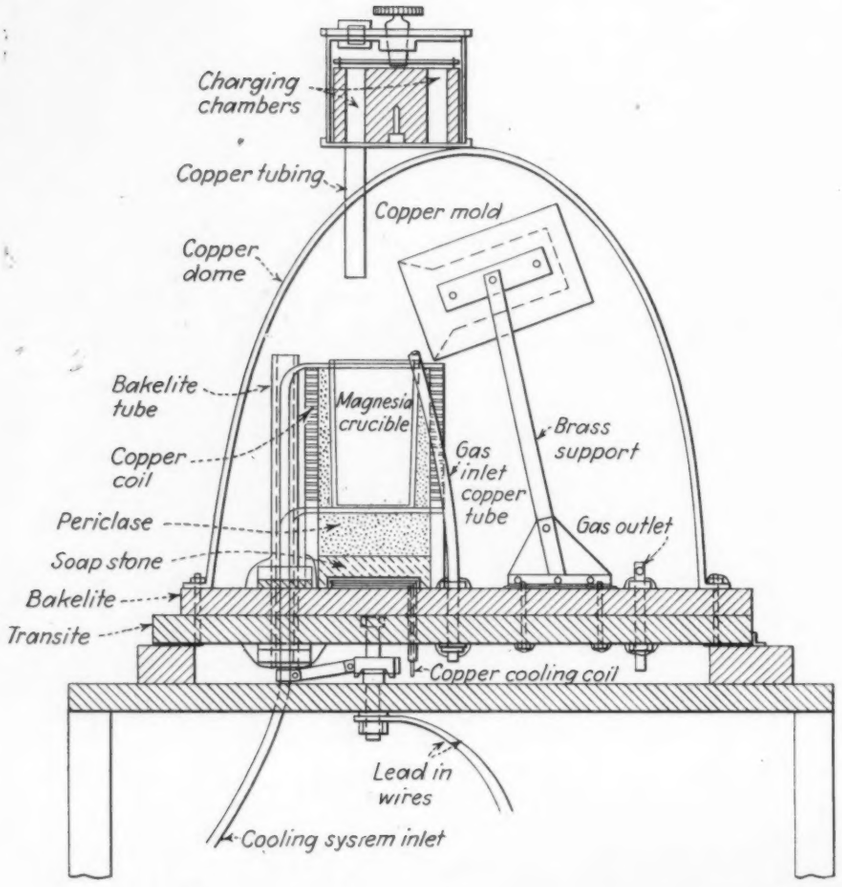
It is known that the melting point of iron is lowered by phosphorus, the effect being somewhat analogous to that of carbon in iron. Both carbon and phosphorus enter into solid solution with ferrite, but in the presence of phosphorus the solubility of the carbon is reduced. According to the existing constitutional diagram of the iron—phosphorus alloys, the amount soluble, even at room temperature, is about 1 per cent, which exists in alpha iron in solid solution.

The excess phosphorus in alloys containing over 1 per cent and under 15.7 per cent phosphorus forms the Fe_3P compound. Very small amounts of phosphorus in higher carbon alloys may likewise form the compound Fe_2P. When this occurs the eutectic may segregate to the grain boundaries and influence adversely the alloy's properties, this becoming more evident as the carbon content increases.

On the other hand, small amounts of phosphorus will raise the tensile strength, elastic limit, and hardness, and decrease the elongation and reduction of area in low carbon steels.

Work on aging of iron alloys with carbon, with oxygen, and with nitrogen, has indicated that the mechanism of hardening and aging in these alloys is associated with precipitation effects. With these elements, the solid solubility in iron decreases rapidly in the temperature region between the critical range and room temperature, so that at room temperature the solid solubility may be less than the amount present. On fairly rapid cooling, at least a part of the amount present is held in solution, but precipiration occurs on heating to the blue-heat region.

Phosphorus also has a similar solid solubility line; but according to the existing constitutional diagram of the iron-phosphorus alloys, the amount soluble even at room temperature is only about 1 per cent; that is, far beyond the amount present in iron or steel in which the characteristic embrittlement phenomena have been



ABOVE

FIG. 1—General view of the high-frequency furnace for melting under a controlled atmosphere.

noted. Accordingly, precipitation effects should be absent.

Because steels contain varying amounts of carbon, silicon, manganese, oxygen, nitrogen, and sulphur, which likewise exert some influence on properties as well as on the behavior of phosphorus, it has hitherto been somewhat difficult to determine quantitatively the effect of phosphorus.

A study* was, therefore, undertaken to determine the manner in which phosphorus alone affects pure iron. The procedure followed was to make up and cast in a helium atmosphere, or vacuum, with varying amounts of phosphorus, pure iron alloys which were as free as possible from the contamination of carbon, nitrogen, oxygen, etc. The effect of phosphorus on the properties of the iron after various treatments was then studied, and in general, the aging characteristics of pure iron-phosphorus alloys observed and analyzed.

Preparation of Alloys

MATERIALS USED: As a base material, hydrogenized electrolytic iron

*Work commenced by author in 1932, while with Battelle Memorial Institute, and completed following his joining Republic Steel Corp., General Metallurgical Research Laboratory, Massillon, O.

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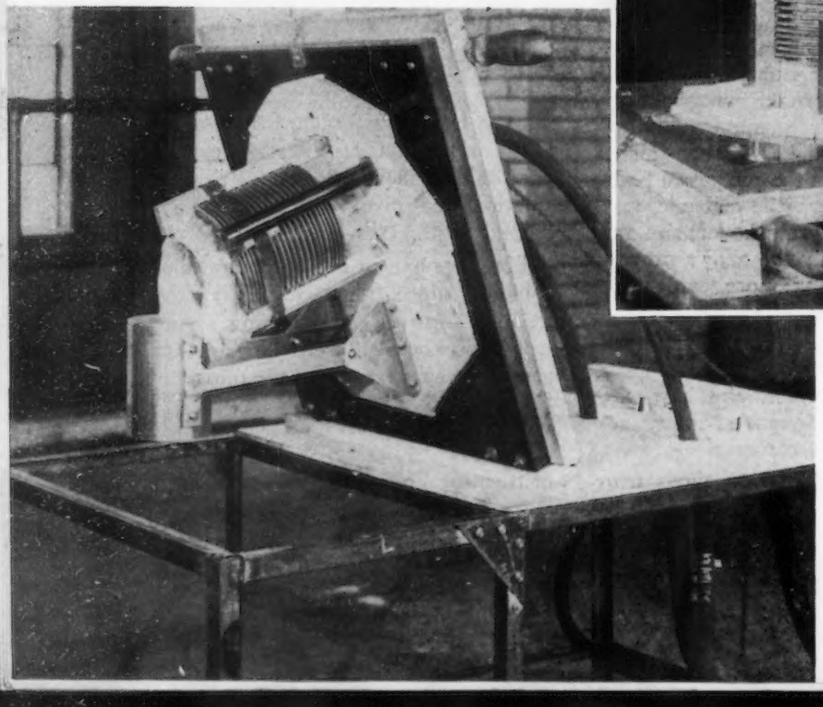
BELOW

FIG. 3—Furnace in tilted position for pouring.



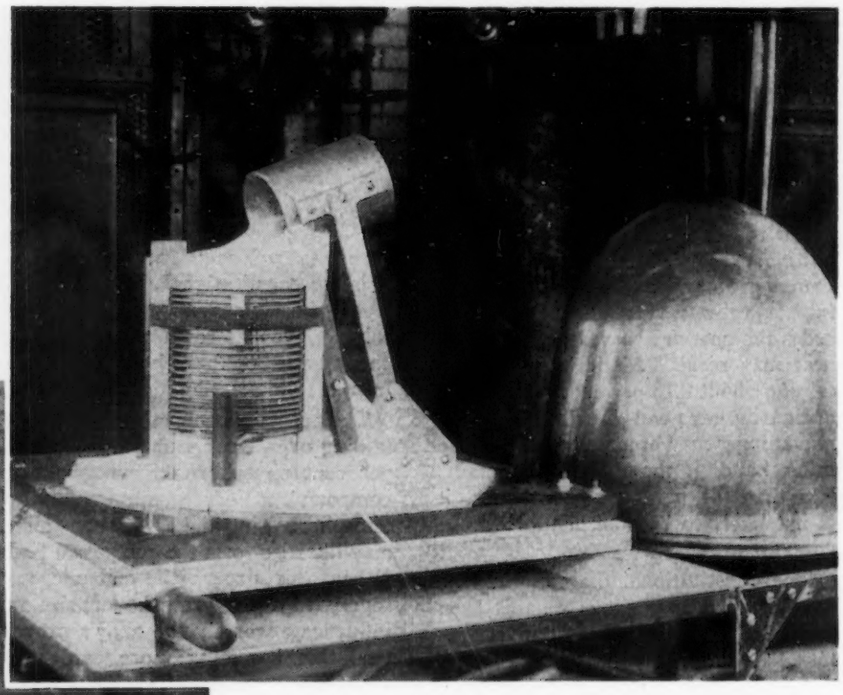


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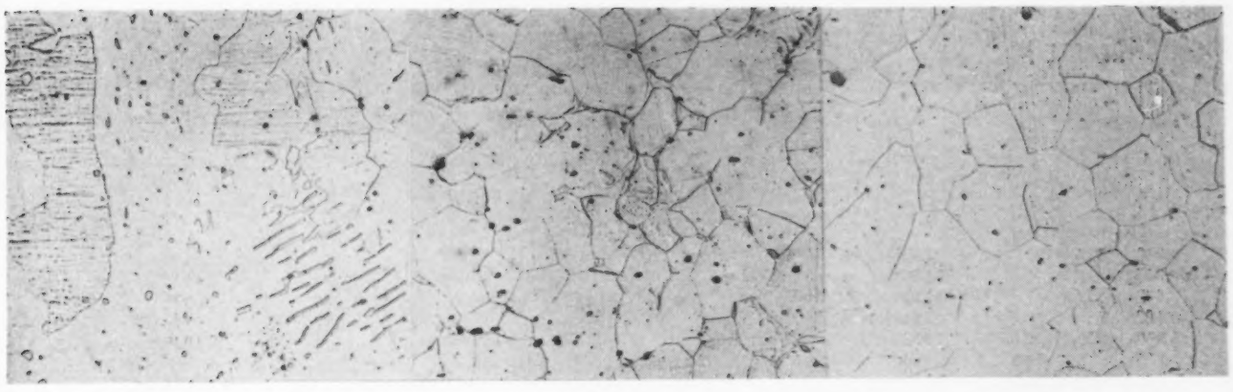
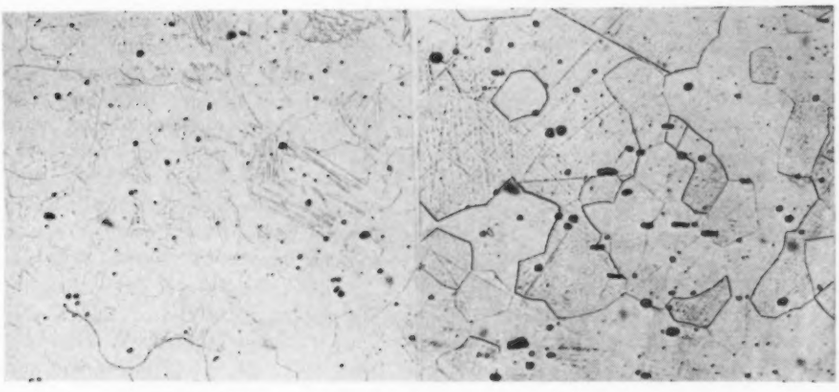
FIG. 2—Furnace in operating position but with dome removed to show the copper ingot mold.



Quenched | Air Cooled | Cooled in Furnace



Quenched | Cooled in Furnace

ABOVE

FIG. 6—Rate of transformation of phosphorus on cooling from the critical range. Alloy of 0.188 per cent phosphorus heated to the gamma (upper micrographs) and alpha plus gamma fields (lower micrographs) and cooled as indicated. At 100 diameters.

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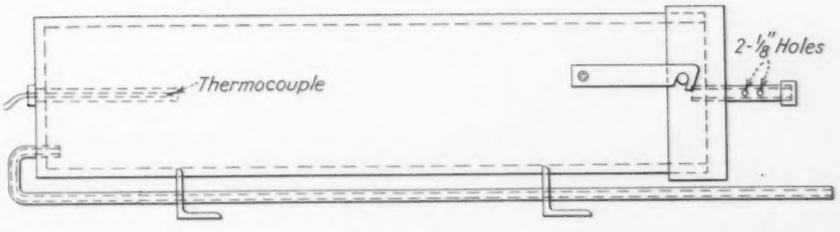
FIG. 4—Hydrogen annealing tube.



was used. This iron was in the form of ½-in. thick flat pieces, one side of which was honeycombed with holes produced during the electrodeposition of the iron. The analysis of this iron was:

0.01 per cent carbon, 0.003 manganese, 0.002 phosphorus, 0.004 sulphur, and 0.0025 silicon.

This iron was reheated in hydrogen before being used. Red phosphorus of high purity was used in making the phosphorus additions.

The helium gas atmosphere was used in melting and the vacuum maintained during the pouring and cooling of the alloy. Ordinarily helium, as manufactured, contains about 3 per cent nitrogen. It was, therefore, purified by passing it through molten lithium before introducing it into the furnace. The lithium, which melts at 185 deg. C., was kept in a steel shell and this held in a pyrex tube heated in a wax bath at 210 deg. C.

The iron was melted in a 98 per cent magnesia crucible in a high-fre-

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RIGHT

FIG. 5—Rockwell B hardness of iron-phosphorus alloys on aging.

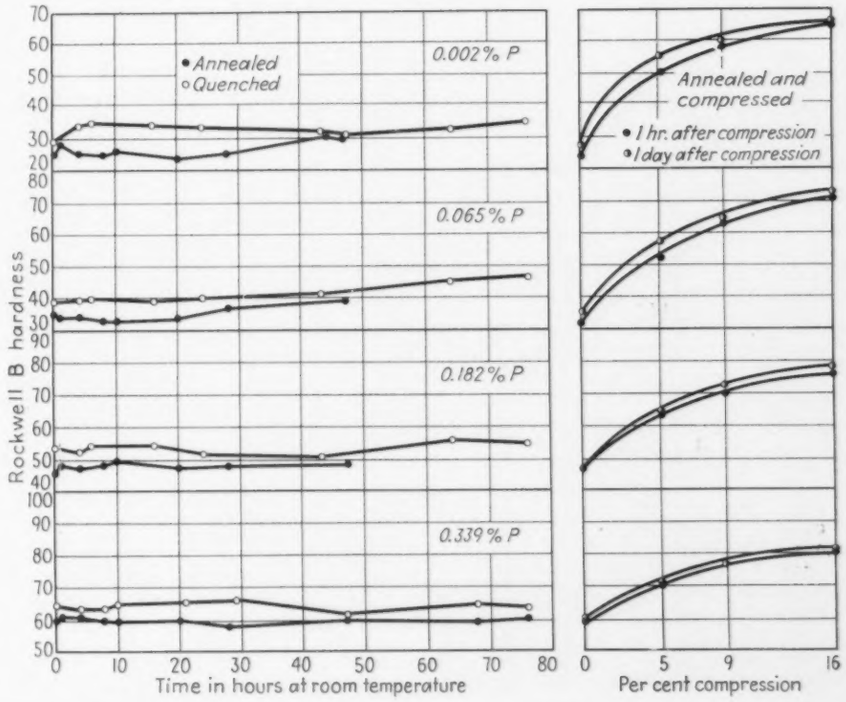

TABLE I
List of Iron-Phosphorus Alloys

Heat No.	Analysis, Per Cent	Phosphorus Recovery Per Cent	Weight of Ingots, Gm.
3	0.002	100	2730
4	0.065	100	2610
6	0.402	...	3030
7	0.182	100	2680
8	0.339	100	2800
9	0.760	92.6	2960
10	1.013	71.0	2540

quency induction furnace under a copper dome, as shown in Fig. 1. The furnace was especially designed for melting and pouring with the dome filled with helium. This method of pouring is illustrated in Figs. 2 and 3. A high conductivity copper mold was used.

Melting, Pouring Procedure

Before charging the hydrogenized iron into the magnesia crucible, it was heated in hydrogen for 8 hr. at 900 deg. C. With the charge, the requisite amount of phosphorus in the form of a previously melted iron-phosphorus master alloy was also added. The copper dome (water cooled) was placed over the furnace and sealed, and the furnace evacuated before turning on the power. Purified hydrogen gas was then introduced to a pressure slightly above one atmosphere. When the charge reached a temperature near the melting point, the current was turned off, the hydrogen evacuated, and helium introduced.

The temperature of the charge was determined with an optical pyrometer through a glass window in the charging chamber, the molten charge then poured into the mold by tilting the apparatus, and the ingot allowed to cool in the copper mold before removing the dome. Thus, the alloys were melted, cast, and cooled in an atmosphere of helium. No difficulty was experienced in getting sound ingots. For the higher-phosphorus alloys the copper mold was sprayed with a wash of bone ash.

The alloys shown in Table I were prepared. Except for the two highest phosphorus alloys, 100 per cent recovery of phosphorus was obtained.

Physical Testing Results

FORGING: To prevent excessive oxidation of the alloys during the heating preliminary to forging, the ingots were placed in an annealing tube as shown in Fig. 4, and hydrogen gas passed through the tube continuously during the heating process.

TABLE II
Charpy Impact Results

Phosphorus Content, Per Cent	Heated to Deg. C.	Energy in Ft.-Lb. Slowly Cooled	Water Quenched
0.002	918	6.0	1.5
0.065	918	9.5	1.0
0.188	950	3.5	1.0
0.330	950	1.2	1.0
0.413	950	1.0	1.0
0.785	960	1.4	0.9
1.24	960	0.7	0.7

TABLE III
Charpy Impact Tests

Phosphorus Content, Per Cent	Heated to Deg. C.	Energy Absorbed Ft.-Lb. Compressed 16 Per Cent Slowly Cooled	Water Quenched
0.002	918	3.5	1.5
0.065	918	4.0	1.0
0.188	950	2.0	1.2
0.330	950	1.5	1.0
0.413	950	1.2	1.0
0.785	960	1.0	1.0
1.24	960	0.9	0.5

The ingots were forged in air under a steam hammer and after forging were buried in lime, and slowly cooled. Observed with a color pyrometer, the forging temperatures varied from 1100 to 1200 deg. C. After forging, the alloys were annealed for 9 hr. at 950 deg. C. in hydrogen.

CHARPY IMPACT TESTS: Four Charpy impact samples were machined from each of the alloys and tested after a heat treatment designed to determine the effect of slow cooling and quenching from within the alpha plus gamma region of the "loop" in the iron-phosphorus constitutional diagram, with results as shown in Table II.

Two of the impact samples were also compressed 16 per cent after the heat treatments and tested with the results shown in Table III.

The impact values were so low that no conclusions could be drawn as to the effect of phosphorus, heat treatment, or degree of compression. It was thought that the low impact values in the lower phosphorus alloys might be due to coarse grain, and grain-refining treatment was, therefore, given the first four alloys by normalizing them from the gamma field. Another set of impact tests were made with the results shown in Table IV.

TABLE IV
Charpy Impact Tests of Normalized Alloys

Phosphorus Content, Per Cent	Normalizing Temperature, Deg. C.	Energy Absorbed, Ft.-Lb.
0.002	910	2.0
0.065	925	1.3
0.182	975	1.0
0.339	1025	0.7

Again the impact values were low. The specimens of the first four alloys were then water quenched three times from the gamma-field temperature range and drawn 4 hr. at 650 deg. C. The results are shown in Table V.

As some grain refinement had occurred as a result of the heat treatments, the conclusion was drawn that the brittleness was not due to coarse grain but to some other cause, possibly the hydrogen annealing. It was evidently not produced by the phosphorus, since the pure iron sample and the 0.065 per cent alloy were also brittle. It should be stated, however, that the pure iron sample was rather coarse grained, and that this was not refined appreciably by the heat treatments employed.

Hardness Tests

The Rockwell "B" hardness increased gradually with increasing phosphorus content. Neither the annealed nor the quenched specimens showed any appreciable change in

TABLE V
Charpy Impact Tests of Heat-Treated Iron-Phosphorus Alloys

Phosphorus Content, Per Cent	Quenched From Deg. C.	Energy Absorbed, Ft.-Lb.
0.002	910	2.0
0.065	925	4.5
0.182	975	2.0
0.339	1025	1.5

hardness upon aging at room temperature. The hardness of the compressed samples, given in Fig. 5, would indicate that the phosphorus tends to reduce the rate at which the hardness increases with cold work. Reheating to either 200 deg. C. or 450 deg. C. after quenching or after annealing did not produce any appreciable change in hardness in any of the phosphorus alloys tested. The hardness tests thus definitely indicated that phosphorus in these alloys had not produced any appreciable aging effects.

Two-Phase Structure

On quenching or after air cooling the iron-phosphorus alloys from the alpha plus gamma field, a two-phase structure was obtained. One was a solid solution richer in phosphorus, and the other a solid solution poorer in phosphorus. If traces of these two-phase structures had been obtained on slow cooling, this might be considered a cause of embrittlement, especially if the higher phosphorus phase formed at the grain boundaries. As shown in Fig. 6, an indication of such a two-phase structure appeared after quenching and also after air cooling from the gamma and alpha plus gamma fields, but not on the sample which was slow cooled in the furnaces.

Solid Solubility in Iron

The solid solubility of phosphorus in iron at room temperature is reported to be about 1 per cent, and an attempt was made to check up on the accuracy of this figure. A quenched sample of the 1.24 per cent phosphorus alloy was heated for 10 days at 450 deg. C. If the solid solubility at 450 deg. C. were appreciably less than 1 per cent, visible precipitation should have occurred. However, no such precipitation took place.

Course of Fracture

In ductile iron and steel, the fracture is known to be transcrystalline. It was of interest, therefore, to observe whether the higher phosphorus alloys which were brittle would give inter-crystalline fractures. As shown in Fig. 7, the pure iron sample gave a trans-crystalline fracture (the white fields in upper portions of micrograph were caused by the coating of electrodeposited copper with which the fracture was protected during polishing. The iron-phosphorus alloys likewise showed evidence of inter-crystalline fracture; but they were not mainly so. It appears more likely that the brittleness in these alloys exists in the interior of the grains as well as at the boundaries.

TABLE VI

Effect of Phosphorus on Carburized Structures

Sample No.	Phosphorus, Per Cent	Grain Size			Depth of Case, In.		
		As Received	Core	Normality	Hyper	Tutect.	Total
3	0.002	Coarser than core	Very coarse	Very abnormal	0.015 to 0.020	0.010	0.070
4	0.065	3/2	3	Very abnormal	0.015 to 0.020	0.010	0.070
7	0.188	3/0	3	Comparatively normal	0.013	0.008	0.070
8	0.330	2/0	2	Abnormal	0.013	0.005	0.080
6	0.413	3/0	2/3	Very abnormal	0.013	0.000	through
9	0.785	1/0	1/0	Very abnormal	0.000	0.000	0.075
10	1.24	0	0	Very abnormal	0.000	0.000	0.080

Phosphorus and Machinability

During the machining of these alloys, it was observed that the chips varied in size and shape. Therefore, in an effort to compare the machinability of these alloys, drilling tests of the iron-phosphorus alloys were made. Using a 5/16 in. high speed drill operating at 670 deg. r.p.m. on constant load, the drillings obtained differed as shown in Fig. 5. Alloys containing 0.002, 0.065, 0.118, and 0.330 per cent phosphorus showed the desired type of drillings, indicating that phosphorus up to 0.350 per cent improves the machinability of the iron.

CARBURIZATION OF IRON-PHOSPHORUS ALLOYS: It is well known that car-

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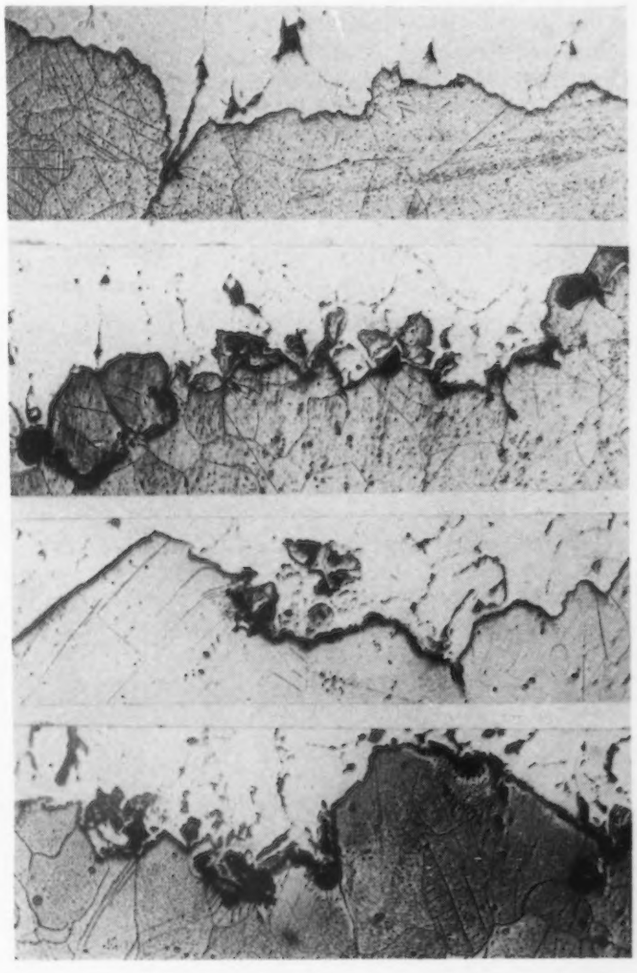

FIG. 7—Path of fracture in iron-phosphorus alloys: 0.002, 0.413, 0.785 and 1.24 per cent phosphorus, top to bottom respectively. At 100 diameters.

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bon in iron presents a considerable obstruction to the diffusion of phosphorus. However, the phosphorus present in alloys has some effect on the rate of diffusion of the carbon itself. The presence of relatively high phosphorus offers some real obstruction to the diffusion of carbon.

CARBURIZING: The effect of phosphorus on the normality, or McQuaid-Ehn carburized structure, was also determined, with results as shown in Table VI.

It is obvious that the phosphorus tends to throw carbon out of solution up to a point in the neighborhood of 0.40 per cent phosphorus.

The first four samples, Nos. 3, 4, 7, and 8, show the increasing refinement of grain size with increases in phosphorus content in the "as-received" samples. On the other hand, samples No. 6, 9, and 10, where the phosphorus content was higher than 0.4 per cent, show an *increase* in grain size with the further increases in phosphorus.

The carburizing of samples up to and including 0.4 per cent phosphorus, show that phosphorus does not oppose the carbon diffusion. However, with samples No. 6 and No. 9 there seems to be no evidence of carbon diffusion taking place in the carburizing, indicating that there is a limit between 0.4 per cent and 0.7 per cent phosphorus which prevents any carbon diffusion.

Summary and Conclusions

The Charpy impact values of the alloys were so low, even after grain-refining treatments, that no conclusions could be drawn as to the effect of phosphorus, heat treatment, or degree of cold working on the impact resistance. Heating in hydrogen may have caused this low impact resistance.

On the other hand, the changes in hardness (Rockwell B) after various treatments could readily be determined. The hardness increased fairly uniformly with increasing phosphorus content.

No perceptible age hardening occurred on quenching and subsequently aging at room temperature, at 200 deg. C. or 450 deg. C.—either with or without cold working. The conclusion appeared, therefore, to be justified that in the absence of other elements such as carbon and nitrogen, phosphorus in amounts up to 1 per cent does not give rise to aging effects. The embrittlement due to phosphorus (in the absence of carbon and nitrogen) does not appear to be due to precipitation hardening but to phosphorus dissolved in the ferrite.

Microscopic examination showed that on quenching the iron-phosphorus alloys from the alpha plus gamma field a two-phase structure is obtained. This duplex structure was not found on furnace cooling, but traces of it remained on air cooling. It does not appear, however, that this comparative sluggishness of the iron-phosphorus alloys in attaining a homogeneous structure on cooling from above the critical temperature can play a very important part in the mechanism of embrittlement, since embrittlement is not overcome by very slow cooling.

The solid solubility of phosphorus in iron at room temperature was found to be not less than 1 per cent, in agreement with several previous investigations. This would also indicate that (in the absence of carbon and nitrogen) precipitation phenomena play no part in phosphorus embrittlement, since this may occur in alloys containing much less than 1 per cent phosphorus.

The fractures of the iron-phosphorus alloys showed some evidence of being inter-crystalline, but they were not mainly so, and it appears doubtful that brittleness in these alloys is caused by inter-crystalline weakness.

Carburizing tests indicated that phosphorus does change the depth of carbon penetration.

Earlier work on the diffusion of carbon in iron and steel, which was done in England, was confined to low phosphorus carbon alloys and the conclusions drawn were that phosphorus had no effect. The present studies show this statement to have been accurate only insofar as it concerned those alloys containing phosphorus up to 0.7 per cent—above which the contrary has now been demonstrated to be true.

Phosphorus appeared to have no effect in either promoting or retarding excessive grain growth produced by cold work followed by annealing at 650 deg. C.

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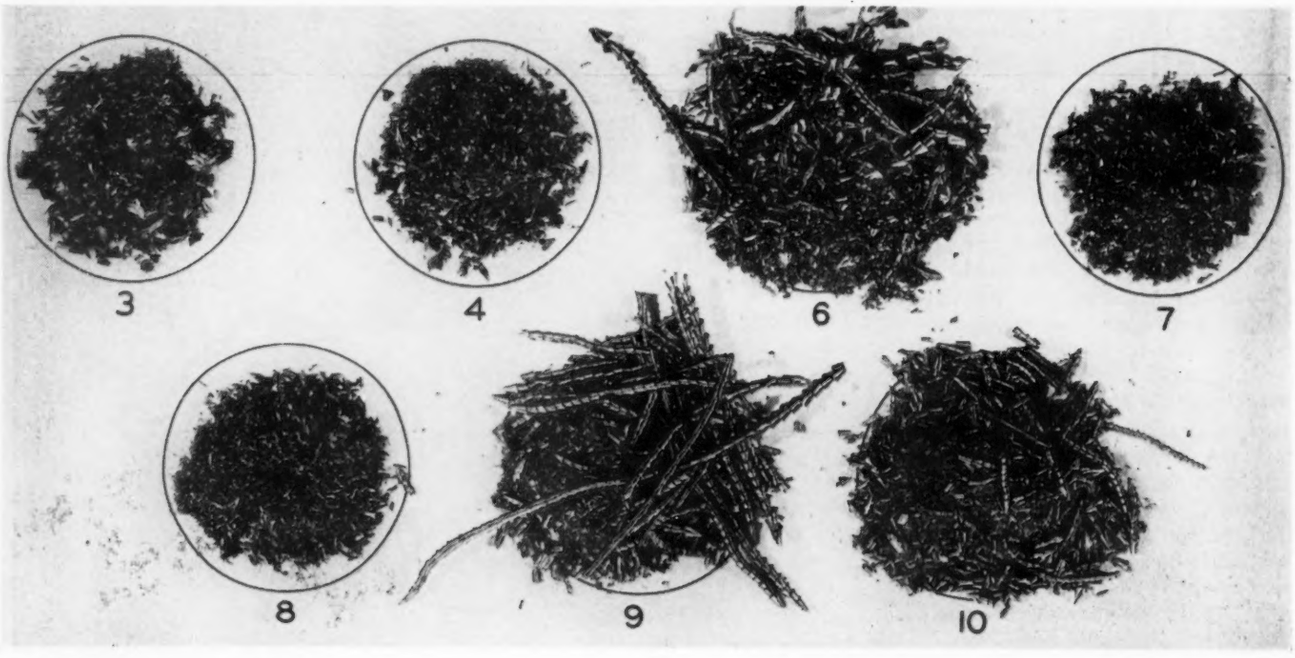
FIG. 8—Drilling tests of iron-phosphorus alloys; 5/16 in. high speed drill at 670 r.p.m. Each sample weighs 10 gm.



Building Up Coupling Boxes

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By D. B. RICE
Welding Engineer, American Manganese Steel Diivsion, Chicago Heights, Ill.

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THREE of the pods of this roll crab have been built up by arc welding. The condition of the fourth and lower pod indicates the excessive wear to which such rolling mill drive members are subjected.

BY selecting the right type of weld metal in building up badly worn spindles, crabs and couplings of roll drives, it is possible to get an equivalent or better wear life than on the original parts, thus more than repaying the cost of repair. As is well known, these rolling mill parts are subjected to extremely severe service, particularly if the separators or stretcher blocks have been improperly maintained. In a continuous type mill, the pounding results in wear on one side of the pods only, while on the reversing mill both sides of the pod are active.

It is sometimes necessary to replace as much as 1½ in. of worn away material on the sides of the pods. If the material is a 0.45 to 0.55 per cent carbon steel, all spalled or loose metal is first removed from the areas to be built up. This is done by means of a cutting torch or by chipping or grinding. The piece is then preheated to a temperature between 400 and 500 deg. F. A carbon steel rod of comparable analysis is used to make the initial deposit and build up these sections to within ½ in. of the finished surface. As applied, each bead must be peened to stress relieve and produce a more dense deposit, thus making the material less susceptible to plastic deformation under impact.

The additional material needed to complete the build-up to template size is applied with electrodes of Amsco nickel-manganese steel, containing 3½ to 4 per cent nickel and 14 per cent manganese, with 0.75 to 0.90 per cent carbon. It is essential that each bead of the nickel-managanese deposit be thoroughly peened not only for stress relief, but also to increase the Brinell hardness of the deposited metal toward its ultimate hardness, which is between 400 and 450 Brinell. This peening operation, is was found, reduces the initial flow of the deposit in service and produces a much smoother finished surface. Any high spots are removed with a hand grinder when welding has been completed so that all surfaces conform closely to the template. As a measure of precaution to prevent spalling in service a dovetail or groove is provided at the back of each pod to allow for any stretch of the weld metal.

In case the part is of the Hadfield or 14 per cent manganese steel analysis, loose or spalled material is removed by grinding. Preheat temperatures is limited to 300 deg. F., as prolonged heating at temperatures above 400 deg. has a detrimental effect on the physical properties of such steel. Heating, however, does not affect nickel-manganese steel. The entire build-up is then made with nickel-manganese steel electrodes, as described.

The procedure for reclaiming of coupling boxes follows that of the spindles and crabs insofar as preparation, preheating and general welding practice is concerned. The initial build-up material, however, should be nickel-manganese steel, which is applied to within ¼ in. of finish dimensions. As all deposits are made on the interior of the casting, peening is difficult and the effects of it, in increased hardness of the material deposited, are not as great. To compensate for this condition and also to provide a metal of different analysis and characteristics to work opposite the nickel-manganese applied to the spindles, the final ¼ in. of metal to reach finish dimensions is deposited with a hard facing welding rod, such as Amsco Hardface electrodes. A coating of tough, impact and abrasion resistant material, having a Brinell hardness between 450 and 500 as deposited, is thus provided where the wear and impact are greatest. This hardface furnishes a dense, smooth deposit free from porosity or other defects and requires very little grinding to produce a surface sufficiently smooth and close to dimensions to be advantageous from a standpoint of wear and adequate bearing.

Flame Hardening Standardization

By A. L. HARTLEY
Metallurgist, R. K. LeBlond Machine Tool Co., Cincinnati

THIS timely research is an important step toward making the flame hardening procedure a more useful and dependable shop tool. In the two preceding parts the author described the characteristics of three types of iron and the effects of various heat treatments; and, results of a complete series of hardening experiments on unalloyed, Cr-Ni and Cr-Mo cast iron by the progressive method. Herein, in the third section of a five-part report, attention is directed to standardized operating conditions for hardening a single flat surface, or two or more adjacent flat surfaces by the progressive method.

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ALTHOUGH the investigations discussed up to this point would be of very great assistance in flame hardening cast iron parts, they have not established a set of standardized operating conditions—they have only outlined the method of approach for establishing such standards. There are many parts which could be flame hardened but are only manufactured in comparatively small quantities, therefore do not warrant the expense involved in conducting experiments. In view of this fact it was deemed advisable to establish a complete set of standardized conditions which would enable an operator to produce satisfactory results without experimental work.

Tentative standards were established on the following factors:

(1) Type of equipment:
- Regulators
- Manifolds
- Torches
- Mixers
- Tips or Burners

(2) Distance between the work surface and tip of burner.

(3) Rate of lineal travel in inches per minute.

No attempt was made to standardize on the number of flames required to harden a given width of surface or on the gas pressures necessary. A wide variety of parts was selected for flame hardening and test pieces of the same general design as each of these parts were run for experimental purposes. The necessary experimental work to produce satisfactory depth of penetration and microstructure was carried out on these sample parts. Very careful records were kept of all experiments conducted and of the final results obtained on the parts hardened. Such parts were also very carefully checked for uniformity of hardness and distortion. A careful analysis of the data obtained from over 300 such tests conducted over an 18 months program indicated that in the particular type of application desired at Le Blond the sections to be flame hardened by the progressive method could be broken down into three general types as shown in Figs. 10, 11 and 12. (Fig. 10 was shown in last week's report.)

Fig. 10 is representative of many parts which have only a single surface to be hardened. Parts of this type may usually be submerged in water or a weak soluble oil solution to a point within about ½ in. of the surface. As shown in Fig. 10 the flames are applied across the entire surface to be hardened.

There are many parts which have two or more adjacent flat surfaces to be hardened. The specimen shown in Fig. 11 and classified as Type 2 is representative. Although Fig. 11 shows the hardened surfaces to be part of a

rectangular block, they may be on almost any type of casting. Many of these can be submerged in a cooling medium. However, it is not absolutely essential that parts of this type should be submerged. A typical example of a large part of such a design that it could not be submerged to a sufficient depth to appreciably affect the hardening conditions will be shown later in this discussion. In flame hardening parts of this general design it is necessary to keep the flames away from the corners, as shown by dimensions B and F in Fig. 11. The magnitude of these dimensions can only be determined by extensive experimental work. The results of such experiments will be shown in tabular form later in this discussion.

Parts of this design must be quenched across the full width of both surfaces. As shown in Fig. 3 (see article in Oct. 17 issue), the type equipment used in these experiments is of such design that the quenching medium is supplied from the torch tip. Hence, the tips for hardening type No. 2 surfaces should be of sufficient width to quench the entire surface and the flame holes not required must be plugged.

The specimen as shown in Fig. 12 is classified as Type No. 3. This type specimen or a slight modification is very frequently found in machine tool parts. In flame hardening sections of this general design it is essential that the flames are not applied to the corners "F" and "B" and that an increased amount of heat is applied in the corner which is adjacent to the unhardened metal.

The results of numerous tests indicated that the special flame arrangement illustrated in Fig. 12 gives the most satisfactory heat distribution for hardening specimens of the type No. 3 design.

As was the case with the type No. 2 specimens, the type No. 3 surfaces should also have the quenching medium applied across the entire width of both hardened surfaces. This may be accomplised by using a tip which has sufficient width to supply the required amount of quench and plugging the flame holes which are not needed.

The data obtained from extensive operating records were carefully classified to the various types of surfaces and tabulated. These data were then transferred to graphs similar to those shown in Figs. 13 and 14. As would be expected from isolated experimental data such as these, there were a few points that were slightly off the regular curves. Accordingly, test bars of the same general design as shown in Figs. 10 and 11 were made. These test bars were made from chromium-molybdenum alloy iron in the complete size ranges from ¼ in. surface width to a 3 in. surface width; 1¼ in. test bars of each type were made from unalloyed cast iron and from chromium-nickel alloy cast iron of the analysis range previously discussed.

Test blocks were not made for the type No. 3 specimen as shown in Fig. 12 because special tips had been designed for hardening the sections of this type, and the operating conditions had been standardized to suit them. A discussion of these results would be of no general interest and will be omitted.

The conditions which were found to produce the most satisfactory results for flat surfaces of chromium-molybdenum alloy cast iron are shown in tabular form in Table V, and graphically on Fig. 13.

The results which were found to give the most satisfactory operating conditions for type No. 2 surfaces are shown in tabular form in Table VI and graphically on curve No. 3, Fig. 14.

The flame locations and number of flames required to harden surfaces from ⅝ in. to 1 9/16 in. wide on type No. 3 section are shown in tabular form in Table VII. However, as previously stated, it has been found advantageous to harden sections of this type with specially designed tips. In view of this fact the operating pressure and recommended mixer sizes are not included on this table. These factors as tabulated on Table VI for the corresponding number of flames will be approximately correct. However, the use of test specimens is recommended before attempting to harden parts which have the type No. 3 section as some minor adjustment might be necessary.

It should be clearly understood that the data as tabulated in Tables V, VI and VII, and shown graphically in Figs. 13 and 14, proved entirely satisfactory with the equipment arrangement as previously described. However, there may be some slight adjustment or revision if satisfactory results are to be obtained if a different type of installation is used. In attempting to apply these data to other installations it would be very advisable first to make the test blocks as described and be sure that the data as tabulated can be applied to the type installation involved.

The photograph shown in Fig. 15 illustrates a typical large part which can be hardened in accordance with the data as tabulated on Table VI and Fig. 14. The photograph shown in Fig. 16 shows this part set up in the flame hardening tank and clearly illustrates the arrangement of the tips. It

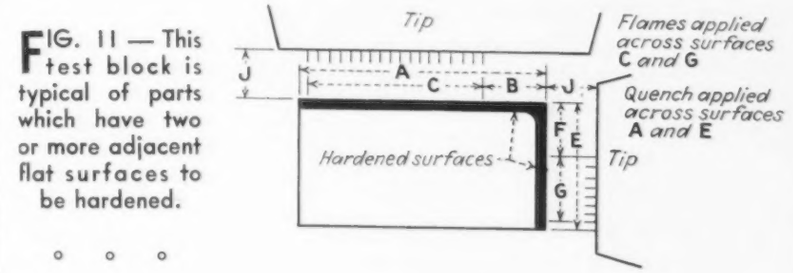

FIG. 11 — This test block is typical of parts which have two or more adjacent flat surfaces to be hardened.

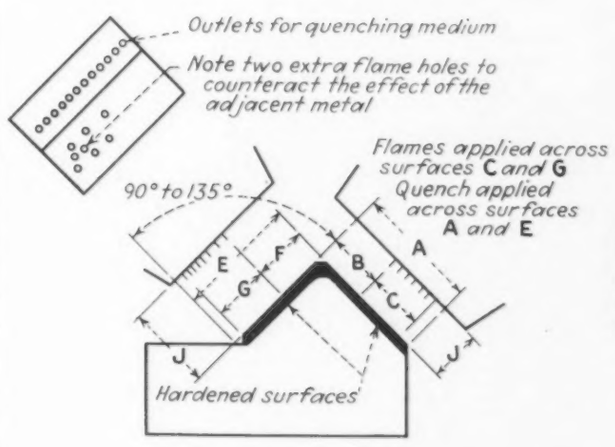

FIG. 12 — This specimen is classified as type No. 3; the metal is adjacent to one side of a vee.

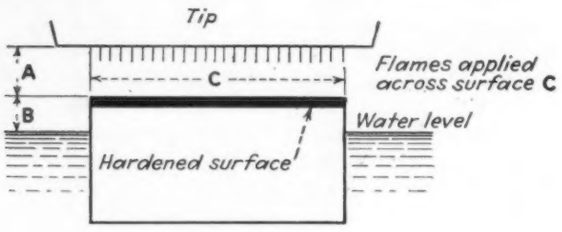

TABLE V

Conditions for Flame Hardening Type No. 1 Surfaces to Produce a 3/32 in. to a 5/33 in. Hard Case.

Width of Surface to be Hardened, In.	Gas Pressure, Lb. Per Sq. In.	Number of Flames	Size Mixer	Distance from Tip to Work, In.	Rate of Lineal Travel, In. Per Min.	Size Flame Holes in Tip	Torch Make and Number
1/4	4 1/4	3	7	5/8	4		
1/2	6 1/2	5	7	5/8	4		
3/4	9	7	7	5/8	4		
1	11 1/2	9	7	5/8	4		
1	7	9	15	5/8	4		
1 1/4	8	11	15	5/8	4	No. 56 drill	Airco 4380
1 1/2	9	13	15	5/8	4		
1 3/4	10	15	15	5/8	4		
2	11	17	15	5/8	4		
2 1/4	12	19	15	5/8	4		
2 1/2	13	21	15	5/8	4		
2 3/4	14	23	15	5/8	4		
3	15	25	15	5/8	4		

Note—The approximate gas consumption per hour per flame is 9.25 to 9.75 cu. ft. of oxygen and 8.75 to 9.25 cu. ft. of acetylene.

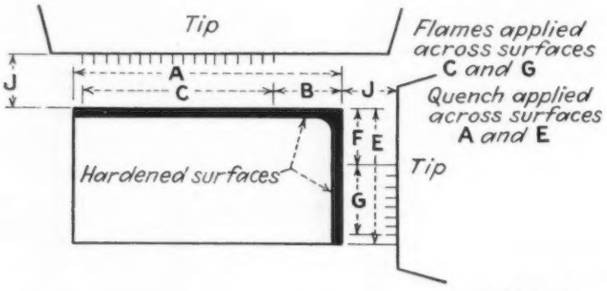

TABLE VI

Conditions for Flame Hardening Type No. 2 Surfaces to Produce a 3/32 in. Hard Case

Width of Surface to be Hardened, In. A or E	Distance to First Flame, In. B or F	Width Across Which Flames are Applied, In. C or G	Gas Pressure, Lb. Per Sq. In.	Number of Flames	Size Mixer	Distance From Tip to Work Surface, In.	Rate of Lineal Travel, In. Per Min.	Size Flame Holes in Tip	Torch Make and Number
3/4	1/2	1/4	6 1/2	3	7	5/8	4		
1	1/2	3/8	8 1/2	4	7	5/8	4		
1 1/4	1/2	5/8	12	6	7	5/8	4		
1 1/2	5/8	3/4	4 1/2	7	15	5/8	4		
1 3/4	5/8	1	5 1/2	9	15	5/8	4		
2	5/8	1 1/4	6 1/2	11	15	5/8	4	No. 56 drill	Airco No. 4380
2 1/4	5/8	1 1/2	7 1/2	13	15	5/8	4		
2 1/2	5/8	1 3/4	8 1/2	15	15	5/8	4		
3	3/4	2 1/8	9 5/8	18	15	5/8	4		
3 1/4	3/4	2 3/8	10 3/8	20	15	5/8	4		
3 1/2	3/4	2 5/8	11 1/8	22	15	5/8	4		
4	3/4	3 1/8	12 5/8	26	15	5/8	4		
4 1/2	3/4	3 3/4	14 1/2	31	15	5/8	4		

Note—The approximate gas consumption per hour per flame is 8 to 8.5 cu. ft. of oxygen and 7.5 to 8 cu. ft. of acetylene.

may be noted that there is a long carbon block set in one end of this part. This block is used to prevent the bottom of a section milled out for a rack seat being hardened. It also prevents the top corners of this cavity from being burned down. It might be added at this point that a steel block is unsuitable for this purpose. Although various other materials have been experimented with, carbon has been found to be the most economical material which is suitable for withstanding the intense heat. Although it may be noted that the water is approximately 9 in. from the top surface and that one of the side surfaces is 1 in. wider than the other, the maximum distortion obtained in hardening this part was 0.035 in. in the entire length of 68¼ in.

The application of the data as tabulated in Table VI and in Fig. 14 to a part such as shown in Fig. 15 is very simple. The narrow side surface No. 1, Fig. 15, has a width of 1½ in. From Table VI it may be noted that the dimension "F" for a surface of this dimension is ⅝ in. and seven flames should be applied across a width of ¾ in. From curve No. 3 it may be noted that a 4½ lb. acetylene pressure is required. For hardening this surface a 2½ in. tip was selected, and the flame holes which were not required were plugged with graphite. As previously mentioned it was necessary to quench a specimen of this type across the entire width, and that was the only reason for using a tip wider than ¾ in. That is, if the wider tip had not been used, it would have been necessary to arrange an auxiliary quenching head and this would have made the set up slightly more complicated.

The width of the No. 2 or top sur-

face is 4½ in. From table No. VI it may be noted that the distance "B" for a 4½ in. surface is ¾ in. In view of the fact that both of the adjacent side surfaces are to be hardened on this part, it would be necessary to apply the flame only over a 3-in. surface. From Fig. 14 a 3 in. surface would require 25 flames, and an acetylene pressure of 12¼ lb. However, as previously stated it was necessary to select a tip which would provide a quench across the entire surface and plug the necessary flame holes.

The surface No. 3, Fig. 15, was 2½ in. wide. From the data as tabulated in Table VI it may be noted that the distance "F" is ⅝ in. and 15 flames should be applied across a width of 1¾ in. From Fig. 14 it may be observed that an acetylene pressure of 8½ lb. is required. A 4 in. tip was selected for hardening this surface. This size tip was used to supply a sufficient width of quench, and the flame holes which were not needed were plugged with graphite.

Torch number and surface number	1	2	3
Width of surface	1½	4½	2½
Tip size	2½	5	4
Actual flame width	¾	3	1¾
Flames per tip	7	25	15
Mixer number	15	15	15
Acetylene pressure	4½	12¼	8½
Distance tip to work surface	⅝	⅝	⅝

A very complete study was made of the microstructures produced when chromium-molybdenum alloy cast iron was hardened in accordance with the data tabulated in Tables V, VI and VII. In addition to the study of the structures of the chromium-molybdenum iron very careful studies were also made of the structures produced when unalloyed and chromium-nickel alloy irons of the type previously discussed were flame hardened under identical conditions. These photomicrographs are shown in Fig. 17.

The specimens from which the photomicrographs shown in Fig. 17 were taken were all flame hardened under identical operating conditions, and as would be expected from the study of the photomicrographs shown in Fig. 4 (see Oct. 17 issue), the depth of hard case was almost identical for the three grades of iron. The scleroscope hardness values as tabulated on Fig. 17 and Table VIII were obtained by taking small blocks of the flame hardened specimens and progressively grinding through the hardened case. This method was used in preference to the tapered block method frequently employed because it eliminated any error which might be caused by a slight variation in the depth of hard case over the length of a long strip.

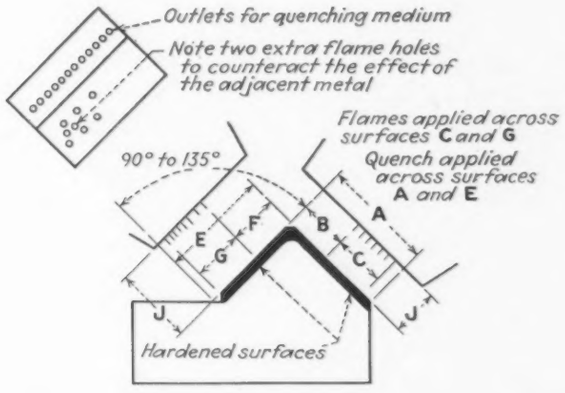

TABLE VII

Summarized Data for Hardening Section Shown in Fig. 15

Width of Surface to be Hardened, In., E	Distance to First Flame, In., F	Width Across Which Flames are Applied, In., G	Number of Flames	Distance From Surface to Tip, In.	Rate of Lineal Travel, In. Per Min.	Size of Flame Holes	Torch Make and Number
⅝	⅜	3/16	4	⅝	4	No. 56 drill	Airco 4380
1	½	¼	5	⅝	4		
1¼	⅝	½	7	⅝	4		
1 9/16	⅝	1 5/16	10	⅝	4		

Note—For data on surface "A" use Table VI and Fig. 14.

The specimens from which the photomicrographs (Fig. 17) were taken were etched for 6 sec. in a 2 per cent nital solution to show the pearlitic base structure and re-etched for 30 sec. in the same solution to show the structure of the hardened zone. They were taken at a magnification of 500 diameters progressively from the base or core metal through the transition zone and out to the flame hardened surface.

The photomicrographs Z-3, F-36 and F-21 show the base structure of the iron used. These structures are all basically the same, namely flake graphite and lamellar pearlite, with no primary or secondary ferrite. It may also be noted that the photomicrographs Z-3, Z-7 and Z-11 shown in Fig. 4

TABLE VIII

Variation in Hardness Between the Base Metal and the Surface of Flame Hardened Cast Iron of Three Types.

Type Iron	Scleroscope Hardness												
	Base Iron	Distance From Base Iron, In.											
		0.005	0.010	0.020	0.030	0.040	0.050	0.060	0.070	0.080	0.090	0.100	0.120	0.125*
1	35	37	43	50	60	67	76	75	76	72	70	70	70	65**
2	38	38	43	60	60	67	75	77	77	76	77	77	76	70**
3	37	37	45	65	75	80	81	82	81	80	77	77	75	70

* Hardened surface.

** The hardness near the surface on type No. 1 and No. 2 irons varied over a much wider range than type No. 3, that is the average value tabulated represented reading of ± 5 points, whereas on the other type it represents a variation of ± 2 points.

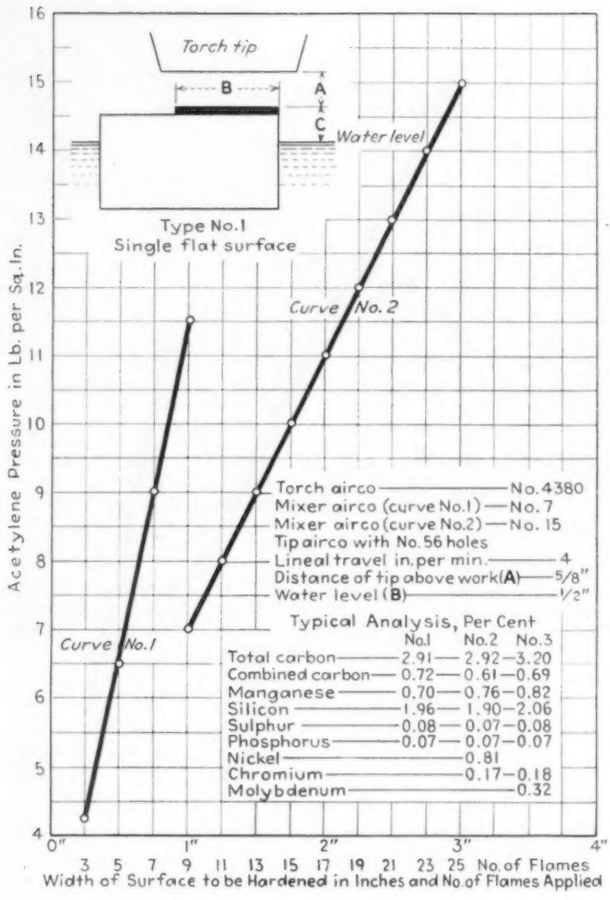
Torch tip
B
A
C
Water level
Type No.1
Single flat surface
Curve No.2
Curve No.1
Acetylene Pressure in Lb. per Sq. In.
Torch airco — No.4380
Mixer airco (curve No.1) — No.7
Mixer airco (curve No.2) — No.15
Tip airco with No.56 holes
Lineal travel in.per min. — 4
Distance of tip above work(A) — 5/8"
Water level (B) — 1/2"
Typical Analysis, Per Cent
No.1 No.2 No.3
Total carbon — 2.91 — 2.92—3.20
Combined carbon — 0.72 — 0.61—0.69
Manganese — 0.70 — 0.76—0.82
Silicon — 1.96 — 1.90—2.06
Sulphur — 0.08 — 0.07—0.08
Phosphorus — 0.07 — 0.07—0.07
Nickel — 0.81
Chromium — 0.17—0.18
Molybdenum — 0.32
0" 1" 2" 3" 4"
3 5 7 9 11 13 15 17 19 21 23 25 No. of Flames
Width of Surface to be Hardened in Inches and No. of Flames Applied

FIG. 13—Satisfactory operating pressure to produce a 3/32-in. to a 5/32-in. hard case on cast irons of the types indicated. These curves apply to flat surfaces on castings of the same basic design illustrated, hardened under the conditions indicated.

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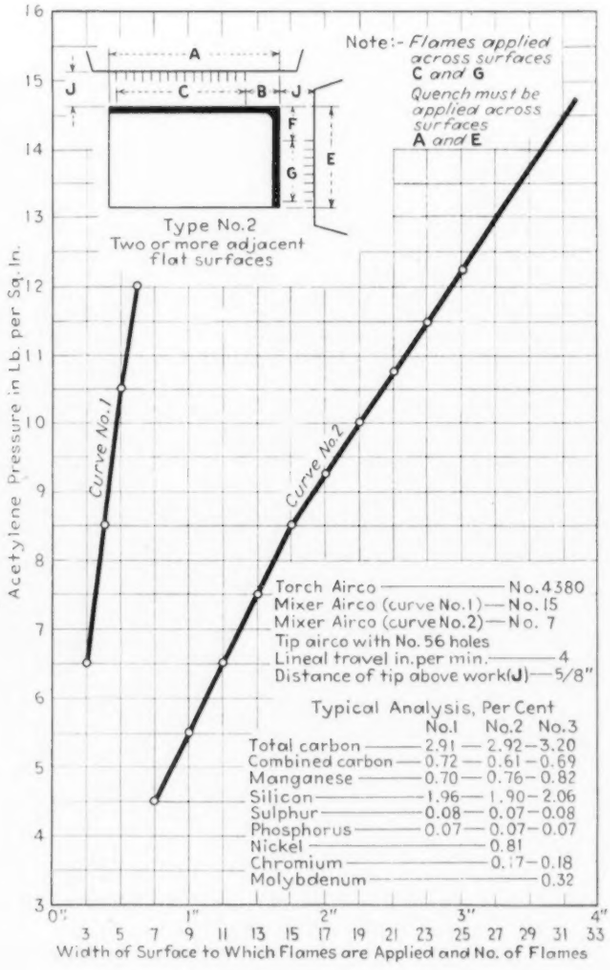
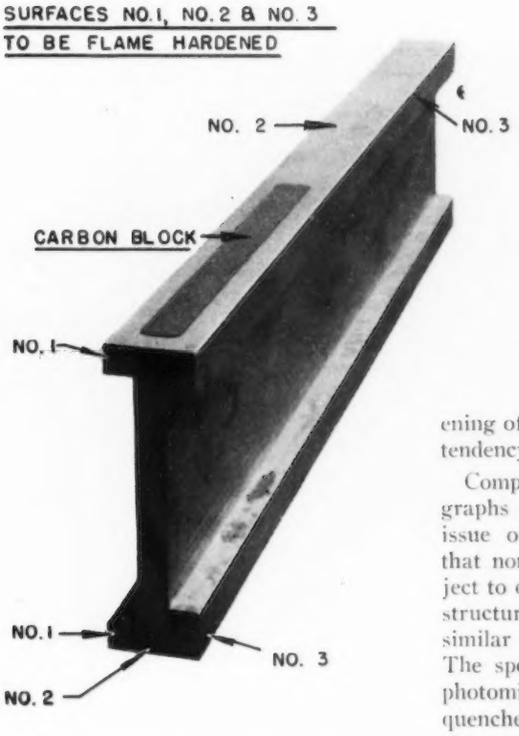
about 55 Rockwell C and a direct comparison on the material involved shows a Rockwell C hardness of 50, a flame hardened cast iron structure which scleroscope 75 is file hard, indicating that the martensitic type structure is formed, and the low reading is probably due to the graphite areas. The same type structure is shown in both of the other types of iron. However, the average hardness is slightly lower, that is about 60 scleroscope. These slightly lower readings are due to the fact that the hardness varied over a much wider range in the case of these materials. That is, there were some scleroscope readings which showed as high as those for the corresponding surface in the chromium-molybdenum iron, but there were also readings which showed a much lower hardness. As the structures are examined at a greater depth into the hardened zone it may be noted that the fine lamellar type structures which are present at a depth of 0.030 in. gradually transform to a definite acicular structure at a depth of 0.050 in. to 0.060 in. from the base or core metal. It may be observed that have an identical structure. The photomicrographs F-300, F-40 and F-23, which were taken at a distance 0.010 in. into the transition zone toward the hardened surface, show small patches of a harder constituent which is not etched by the 2 per cent nital solution. It may also be noted that the scleroscope hardness at this zone is slightly above that of the base material. Going deeper into the transition zone, that is to a depth of about 0.020 in. or 0.030 in., the lamellar structure is practically gone and there is a transition type structure which is not affected by the 6 sec. etch in 2 per cent nital, and the hardness has increased very appreciably. The photomicrograph F-26 of the chomium-molybdenum alloy iron at a depth of 0.030 in. from the base metal shows the appearance of the structure when etched for 6 sec. The photomicrograph F-27 shows the same field after the specimen was re-etched for 30 sec. in the same reagent. In this photomicrograph it may be noted that there is a very fine lamellar type structure which seems to be tending to an acicular structure. At this depth into the hardened zone the scleroscope hardness is 75. Although the conversion charts commonly applied for steel would show that this is only

o o o

FIG. 14—Satisfactory operating pressure to produce a 3/32-in. to a 5/32-in. hard case on cast irons of the types indicated. These curves apply for two or more adjacent flat surfaces on castings of the same basic design illustrated. Hardened under the conditions indicated.

o o o


Note:- Flames applied across surfaces C and G
Quench must be applied across surfaces A and E
A
J
C
B
J
F
G
E
Type No.2
Two or more adjacent flat surfaces
Curve No.1
Curve No.2
Acetylene Pressure in Lb. per Sq. In.
Torch Airco — No.4380
Mixer Airco (curve No.1) — No.15
Mixer Airco (curve No.2) — No.7
Tip airco with No.56 holes
Lineal travel in.per min. — 4
Distance of tip above work(J) — 5/8"
Typical Analysis, Per Cent
No.1 No.2 No.3
Total carbon — 2.91 — 2.92—3.20
Combined carbon — 0.72 — 0.61—0.69
Manganese — 0.70 — 0.76—0.82
Silicon — 1.96 — 1.90—2.06
Sulphur — 0.08 — 0.07—0.08
Phosphorus — 0.07 — 0.07—0.07
Nickel — 0.81
Chromium — 0.17—0.18
Molybdenum — 0.32
0" 1" 2" 3" 4"
3 5 7 9 11 13 15 17 19 21 23 25 27 29 31 33
Width of Surface to Which Flames are Applied and No. of Flames



o o o

FIG. 15—This is a typical large part which can be hardened in accordance with the data as tabulated in Table VI and Fig. 14.

o o o

the microstructures become more acicular as the hardened surface is approached. However, with the exception of the unalloyed iron there is no great tendency toward excessive coarsening of the martensite, and there is no tendency toward microscopic cracks.

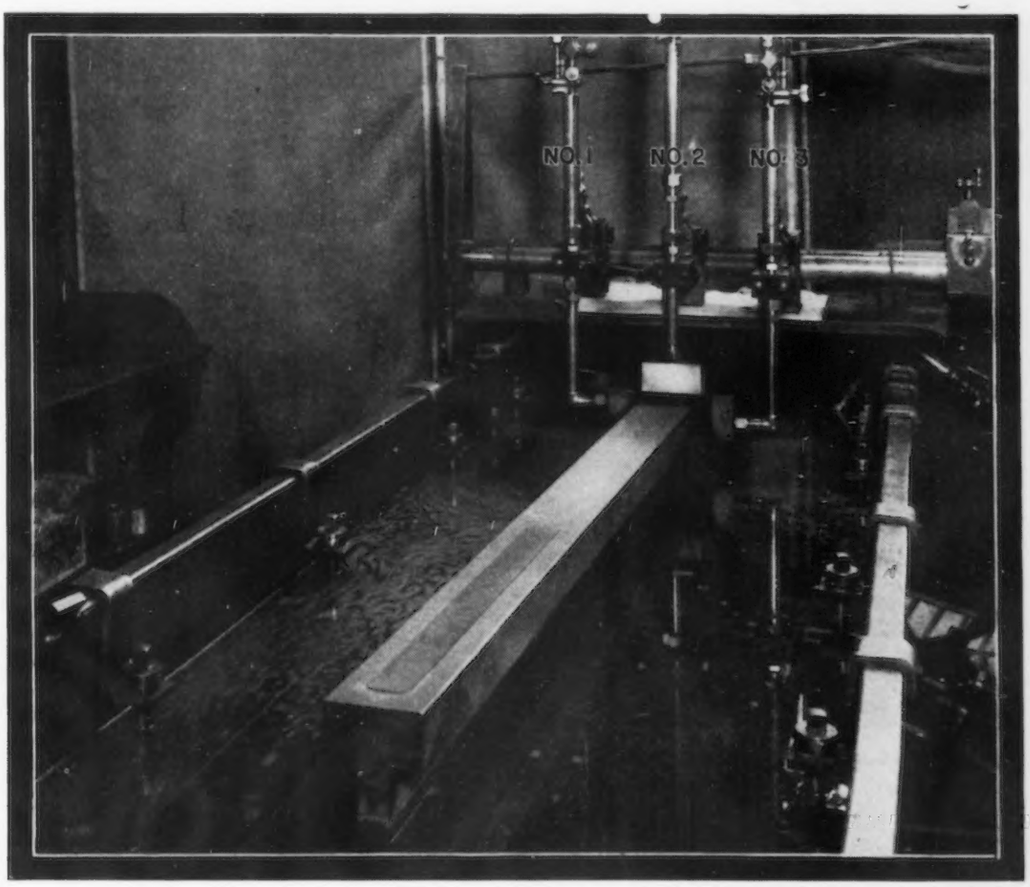
Comparison of these photomicrographs to those shown in Fig. 4 (see issue of Oct. 17) clearly illustrates that none of the specimens were subject to overheat. The hardened surface structure for the No. 1 iron is very similar to that shown in Fig. 4, F-322. The specimen from which this latter photomicrograph was taken was oil quenched from 1600 deg. F. Although there are some microscopic cracks visible in both photomicrographs, a complete examination of the specimen revealed that there are more cracks in the furnace hardened specimen than in the flame hardened specimen.

Comparing the photomicrograph F-63, Fig. 17, which shows the flame hardened surface of type No. 2 iron with the photomicrograph F-313 and F-324, Fig. 4, it would appear that the effective surface temperature was some place within the range of 1525 deg. F. and 1550 deg. F.

A comparison between the photomicrograph F-34, Fig. 17, which shows the flame hardened surface of type No. 3 iron, and F-104, Fig. 4, it may be observed that an almost identical structure is produced. This would indicate that the effective surface temperature was approximately 1550 deg. F.

From the foregoing comparisons it would seem evident that the effective surface temperatures of the specimens hardened under the conditions as discussed previously are well within the desired range as they in no instance exceeded 1600 deg. F.

Table VIII shows the hardness variations from the base metal to the hardened surface for the three types of iron tested. From this table it may be noted that the type No. 3 iron shows a slightly higher average hardness. It may also be noted from this chart that in all instances the hardness dropped approximately 5 points as the speci-



o o o

FIG. 16—The part shown in Fig. 15 is set up as shown here in the flame hardening tank.

o o o

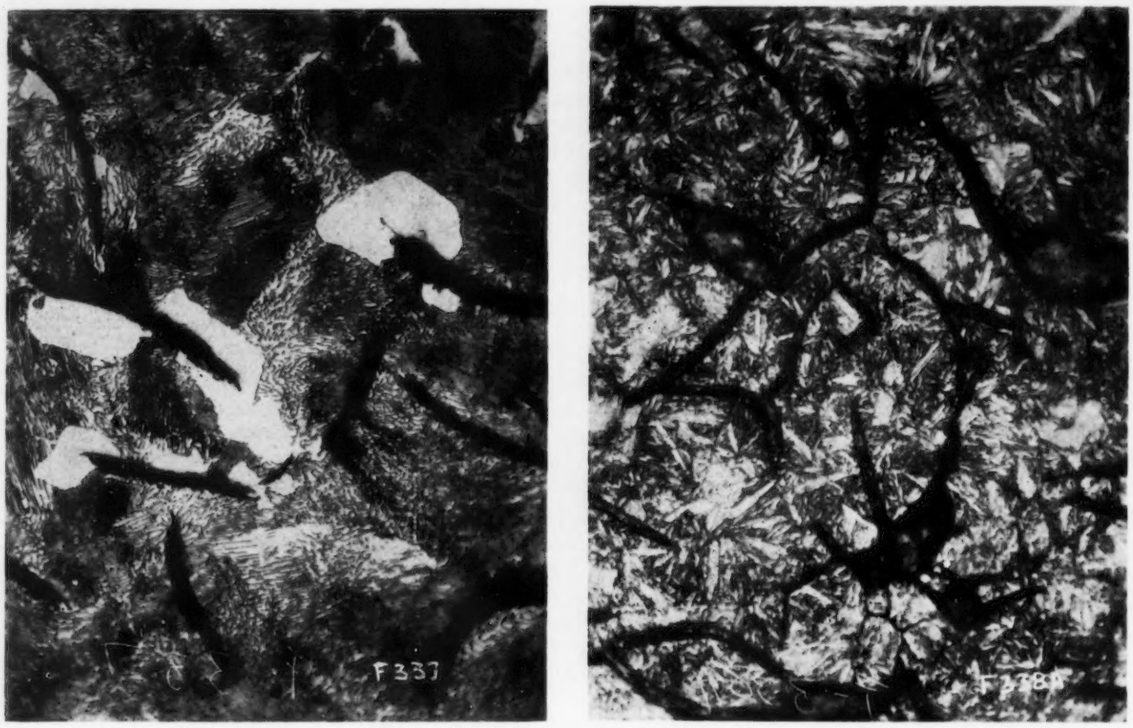


FIG. 18—Results obtained when a molybdenum alloy iron which has secondary ferrite present in the base structure (left) is flame hardened under proper operating conditions. Both views at 500 diameters; 2 per cent nital etch.

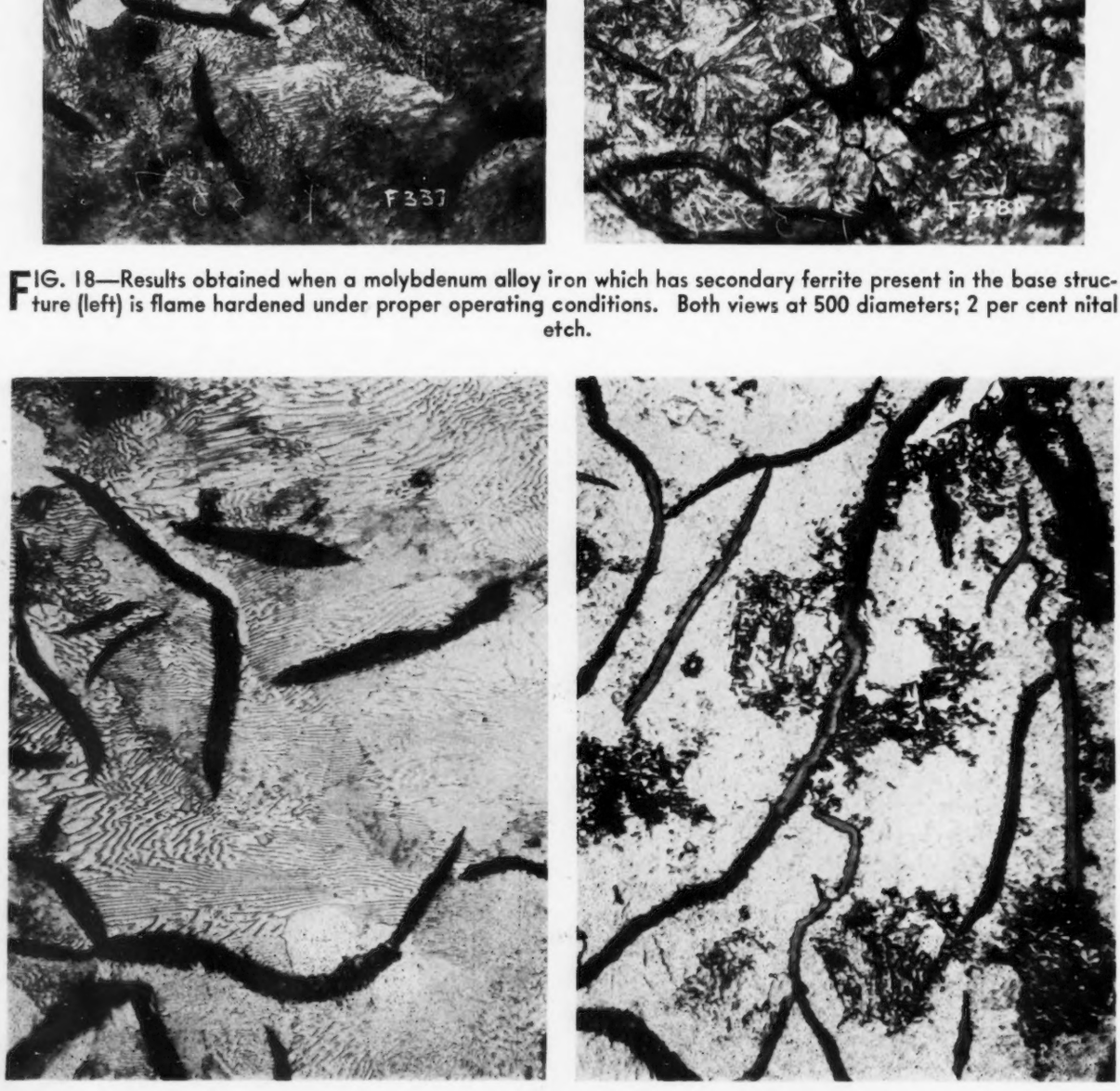
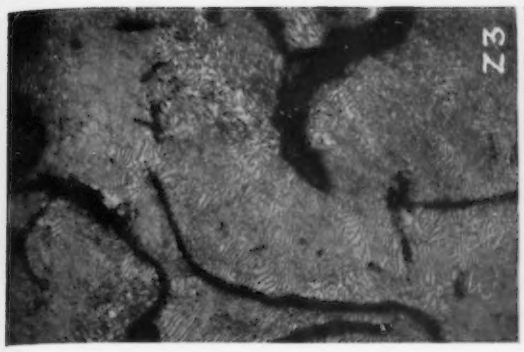
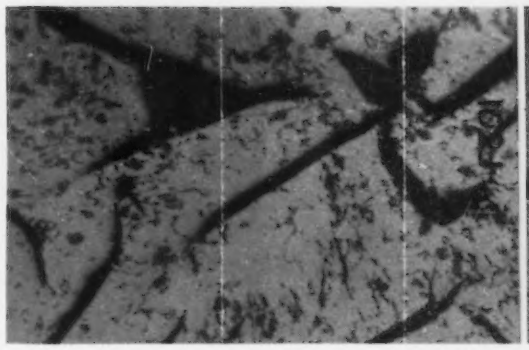
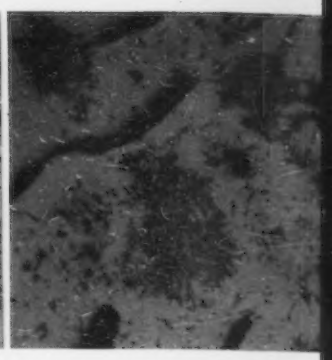


FIG. 19—Results obtained when the base iron (left) has secondary ferrite and is not hardened under proper operating conditions. Flame hardened iron at right. Both views at 500 diameters; 2 per nital etch (left) and 5 per cent (right).

UNALL

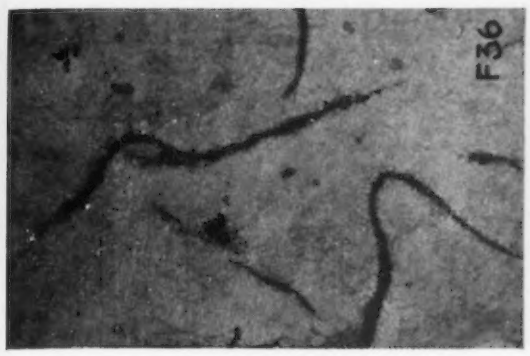


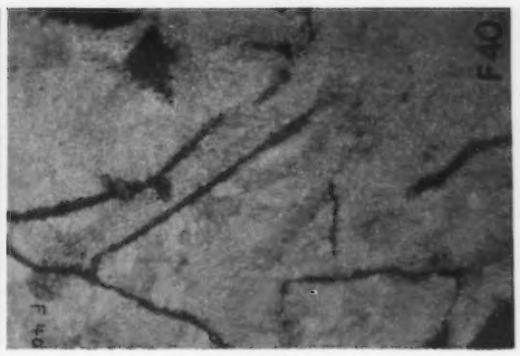


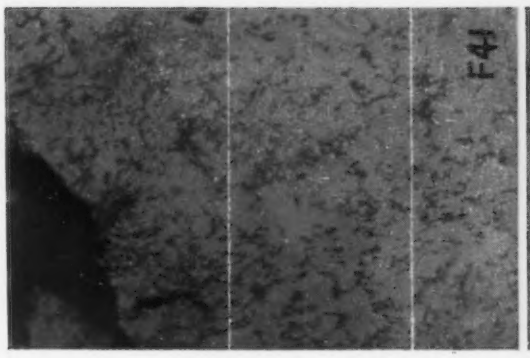


DISTANCE FROM BASE IRON	.000"	.010"	.025"	.040"
HARDNESS SCLERESCOPE	35	43	60	67

CHROMIUM NICK

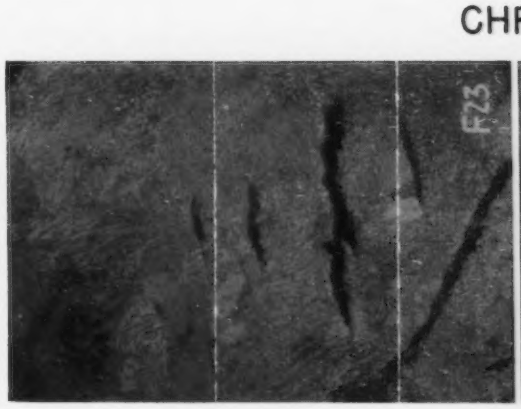






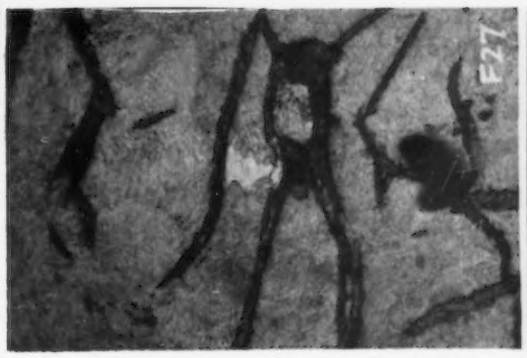
DISTANCE FROM BASE IRON	.000"	.010"	.020"	.030"
HARDNESS SCLERESCOPE	38	43	60	60

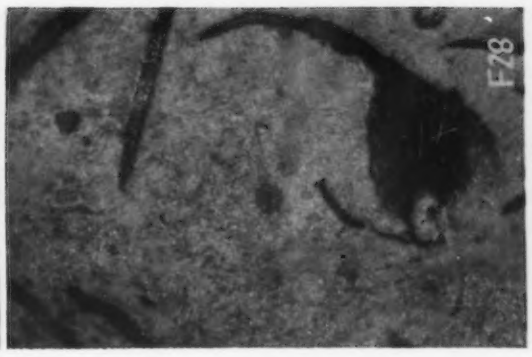
CHROMIUM MOLYBD

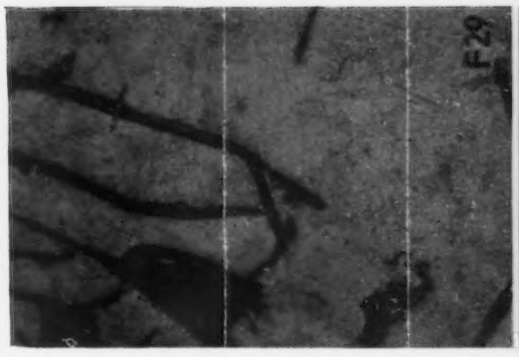


DISTANCE FROM BASE IRON	.000"	.005"	.010"	.020"
HARDNESS SCLERESCOPE	37	37	45	65

CHROMIUM MOLYB

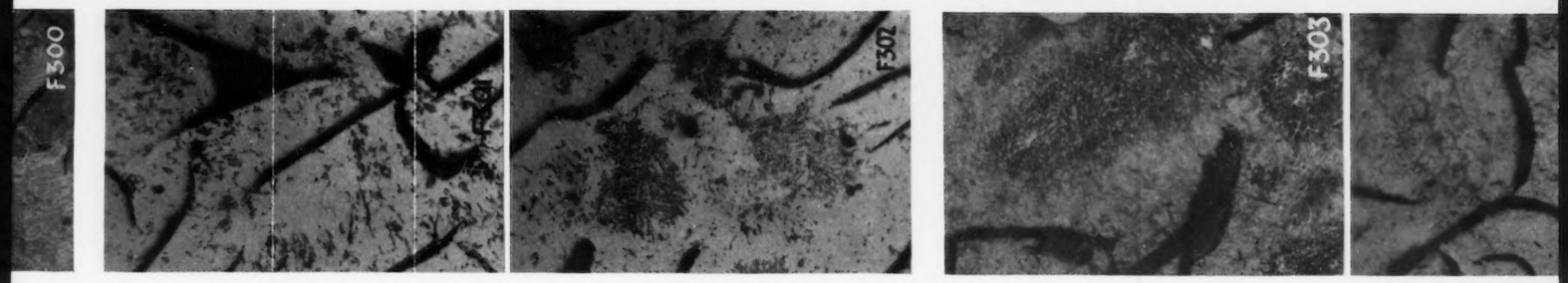






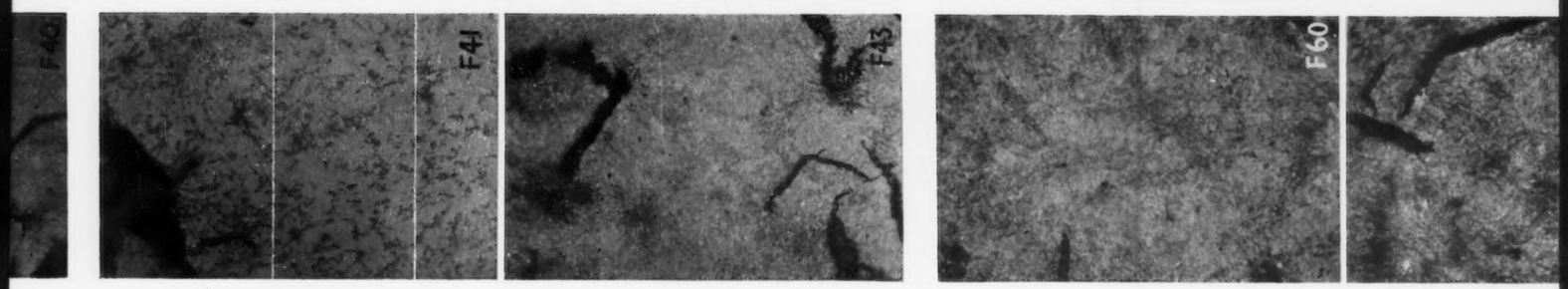
DISTANCE FROM BASE IRON	.030"	.035"	.040"	.045
HARDNESS SCLERESCOPE	75	80	80	8

UNALLOYED IRON FLAME HARDENED



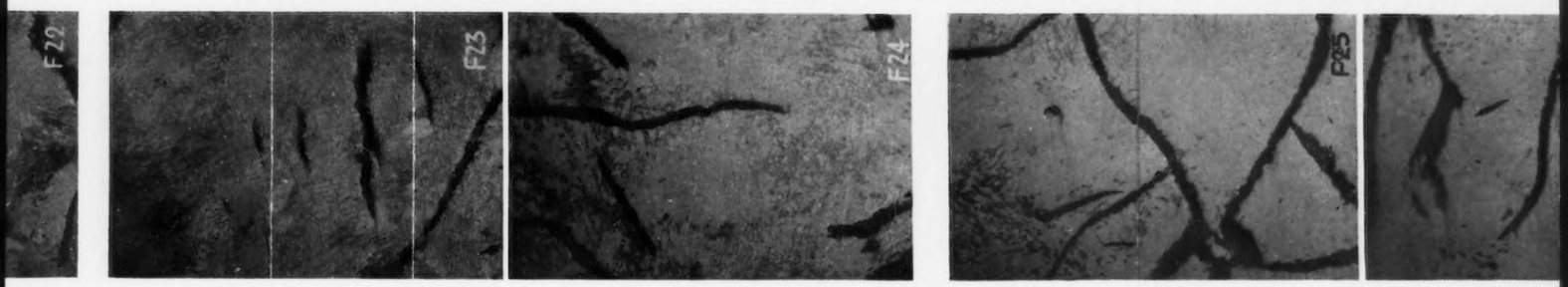
.025"	.040"	.040"	.06
60	67	67	75

CHROMIUM NICKEL ALLOY IRON FLAME HARDENED



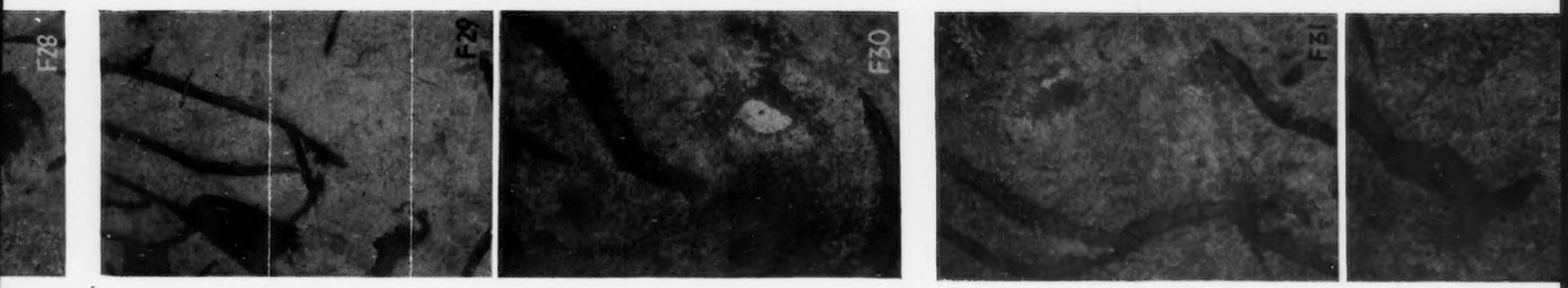
.020"	.030"	.035"	.0
60	60	65	

CHROMIUM MOLYBDENUM ALLOY IRON FLAME HARDENED



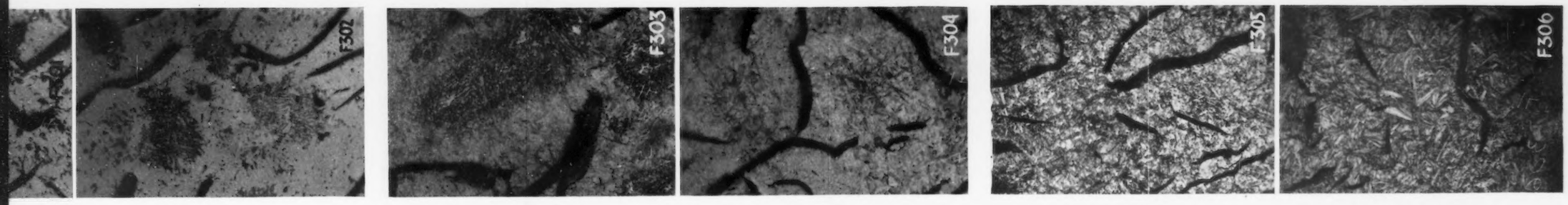
.010"	.020"	.025"	.03
45	65	75	7

CHROMIUM MOLYBDENUM ALLOY IRON FLAME HARDENED



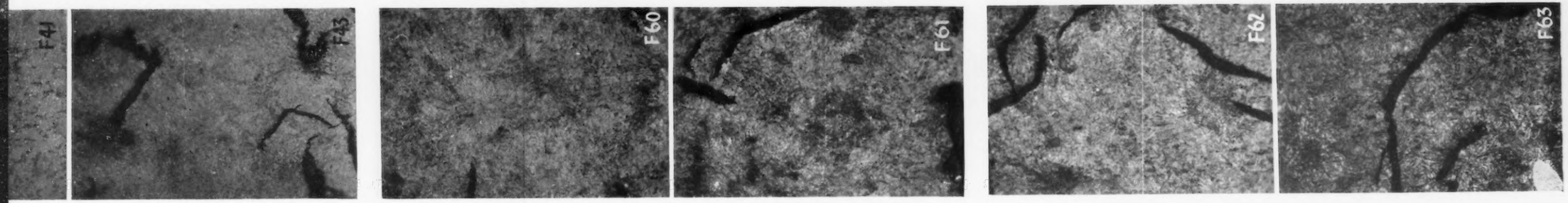
.040"	.045"	.050"	.055
80	81	81	82

UNALLOYED IRON FLAME HARDENED



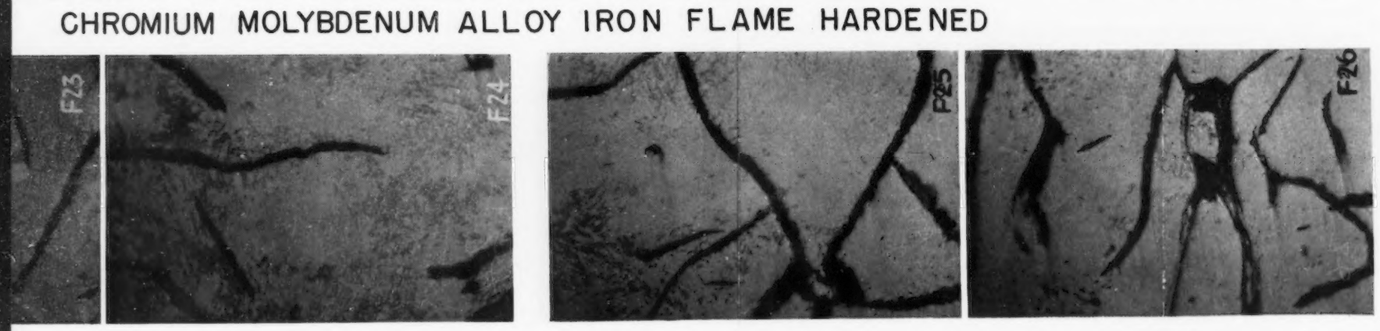
.040"	.040"	.060"	.080"	HARDENED SURFACE
67	67	75	76	65

CHROMIUM NICKEL ALLOY IRON FLAME HARDENED



.030"	.035"	.045"	.055"	HARDENED SURFACE
60	65	75	77	70

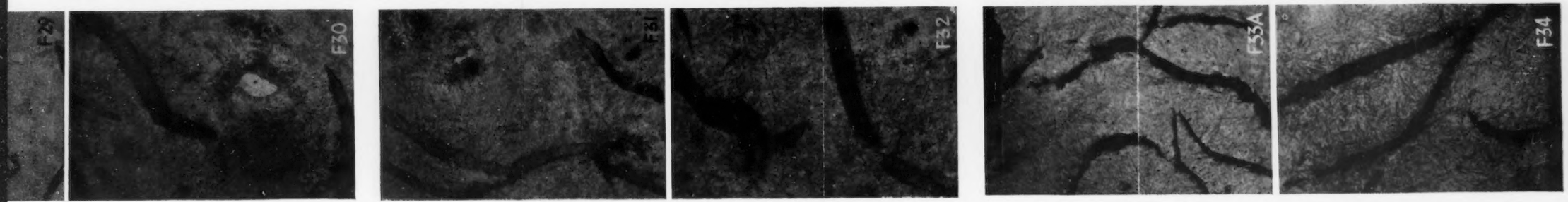
CHROMIUM MOLYBDENUM ALLOY IRON FLAME HARDENED



.020"	.025"	.030"
65	75	75

FIG. 17—Microstructures produced when chromium-molybdenum alloy cast iron is hardened in accordance with the data tabulated in Tables V, VI and VII. All views at approximately 500 diameters. Irons etched with 2 per cent nital solution.

CHROMIUM MOLYBDENUM ALLOY IRON FLAME HARDENED



.045"	.050"	.055"	.060"	HARDENED SURFACE
81	81	82	82	70 TO 75

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mens are checked directly on the hardened surface. Although it is entirely possible that there may have been a very thin surface layer which was overheated a sufficient amount to produce a coarser structure, it is believed that this drop in hardnesss was due to decarburization. However, this is only a theory and has not been substantiated in the case of irons which have been flame hardened under proper operating conditions. However, it has been definitely established by experiments not discussed in this paper that a carbon loss does take place when cast irons are flame hardened under conditions which slightly overheat the surface.

The foregoing photomicrographs and hardness studies clearly show the following factors to be true:

(1) **The transition zone is of very appreciable width, usually 0.020 in. to 0.025 in. minimum.**

(2) **The structure from the flame hardened surface to within 0.020 in. or 0.025 in. of the core or base metal ranges from a moderate acicular or martensitic structure to a transition type structure which is of very fine lamellar constituent.**

(3) **The structure from about 0.020 in. above the base metal down to the base metal gradually transforms from the very fine lamellar type transition structure to a definite pearlitic base.**

(4) **There is no plane or layer of secondary ferrite produced between the base metal and the hardened structure when irons of the analysis herewith discussed are flame hardened in accordance with the recommended procedure.**

The foregoing factors should definitely establish the fact that a properly flame hardened cast iron part will not have a tendency to chip or spaul unless given excessive abuse. However, to refer to the photomicrographs in Fig. 5 (Oct. 24 issue), which show the structures produced when improper technique is used, it can readily be seen why there has been a certain amount of trouble encountered from the above type failures. Severe overheating combined with an excessively drastic quench will not only produce a very coarse surface structure but will also result in a sharp transition zone. Such technique would, of course, produce an inferior part, which would fail under very mild impact or shock condition.

In the foregoing discussion only those irons which have a good pearlitic base structure with moderately fine graphite flakes, have been considered. However, there are certain types of application where an iron having a coarser structure, that is larger graphite flakes, would be desirable. Although machine tool builders have been constantly striving to obtain a high strength iron with a very fine graphite structure and a lamellar pearlite matrix, it may be that they have overlooked a point that is of vital importance for many parts.

It is well known that cast iron is far superior to steel from the standpoint of damping vibrations. However, as the characteristics of steel are more nearly approached this damping characteristic is reduced. Prior to the introduction of flame hardening it has been essential to avoid the presence of either secondary ferrite or primary ferrite in the structure of castings which will be subject to wear. This condition made it necessary to continuously strive for a completely pearlitic iron. For example, a lathe bed made from a casting whose structure contains excessive primary or secondary ferrite will score and scratch when put in service.

The photomicrographs shown in Fig. 18 illustrate the structures produced by flame hardening an iron which contained a very appreciable amount of secondary ferrite in the base structure. This iron had the following analysis:

Total carbon	3.30
Combined carbon	0.58
Silicon	1.57
Manganese	0.82
Molybdenum	0.44
Chromium	0

The specimen used for this photomicrograph was taken from a 1½ in. flat surface of the type shown in Fig. 13. The iron had been flame hardened in accordance with the data as tabulated on that curve. It may be clearly observed from the photomicrograph F-337 that there are large areas of secondary ferrite present in the base metal. Photomicrograph F-338-A shows the very definite martensitic structure produced by flame hardening. Although this structure is not nearly as uniform as that produced from the better grade of base material as shown in Fig. 17, it will resist wear and for parts not subject to severe impacts will probably give very satisfactory results. Although the hardness of the base iron was only 167 Brinell, the flame hardened surface was 75 to 80 scleroscope or 50 to 52 Rockwell C.

A complete microscopic exploration of the hardened zone showed that there was no secondary ferrite present until the transition area was reached. As would be expected, the secondary ferrite was present in the transition zone to a point about 0.020 in. to 0.030 in. into the hardened area. However, there were no areas found in which the amount of secondary ferrite in the transition zone exceeded the amount in the base metal.

Although extensive experiments with this type iron have not been conducted, it may have definite advantages for certain types of parts where high strength is not essential and where maximum damping capacity is of vital importance. Another advantage of this type material for parts that do not require high strength and will not be subject to severe impact is the fact that it is very readily machineable and for many parts would greatly reduce costs. The adoption of such a material for flame hardened parts should only be made after flame hardening conditions are carefully established and standardized. To illustrate this the photomicrographs as shown in Fig. 19 are included. It may be noted from the photomicrograph showing the base iron that this material has much less secondary ferrite than the sample shown in Fig. 18. However, the flame hardened structure is very ununiform and would not be suitable for parts subject to appreciable wear.

Although it would not be advisable to definitely recommend the use of a soft material of this type, it does warrant careful investigation, and it may be found that the advantages obtained by improved machineability and improved vibration damping characteristics will more than offset the disadvantages of the slightly lower strength and more open appearance.

Ed. Note—Next week the author continues with the fourth section of this report.

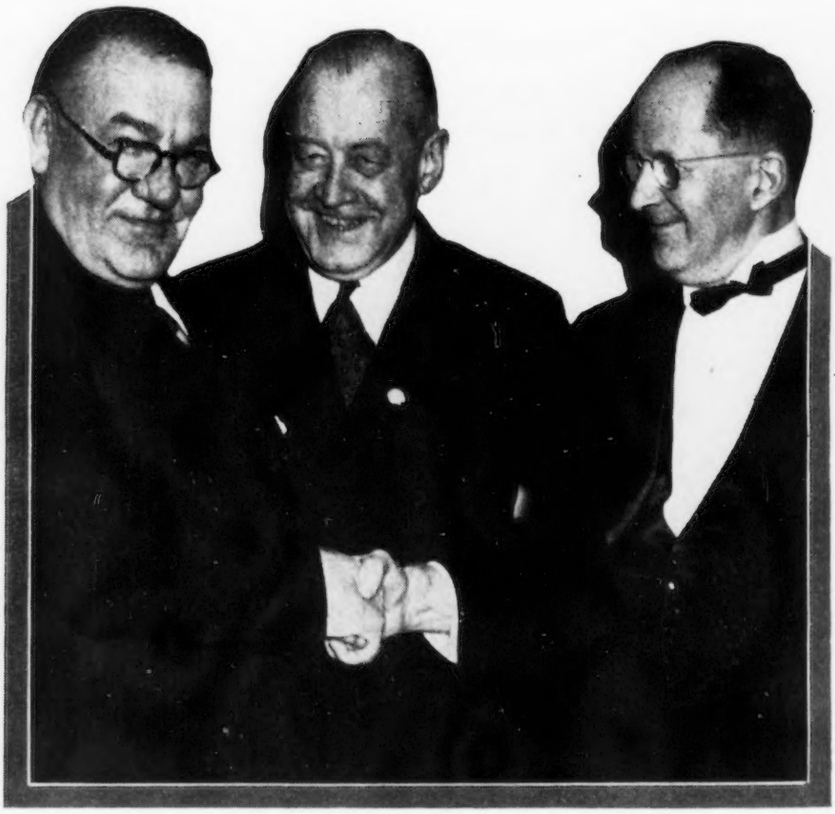
Defense Theme Dominates Metal Congress

THE national defense theme appeared in virtually every phase of last week's National Metal Congress and Exposition at Cleveland and testified that America's metals and metal working industries can cope with any armament problem no matter how fast the demands may change.

Last week's lectures and exhibits indicated that most of the major problems and costly defects of the World War have been overcome. Vast improvements have been made in producing, heat treating, forming and finishing metals. America has important new alloys, faster machine tools, better materials handling equipment, and new controls eliminating errors. There is less waste and wider use of welding.

Most important of all, America can rely upon its experienced manpower in the fields of metals research and production.

Never before held under similar national and world conditions, the twenty-second Congress and Exposition achieved a new top in the square footage of exhibit space. Aggregate attendance failed to set a record, but compared favorably with past shows when there was no press of business to keep many executives away. Welding played a more prominent part than ever. The four cooperating societies (American Society for Metals, the American Welding Society, the Iron & Steel and Institute of Metals Divisions of the American Institute of Mining and Metallurgical Engineers, and The Wire Association) held 43



GEN. HUGH S. JOHNSON, Scripps Howard columnist (left), principal speaker at A.S.M. banquet; W. W. Rose of Gray Iron Founders' Society, Inc.; and John H. Van Deventer, editor, THE IRON AGE (right).

sessions with over 150 varied technical papers. Next year's Congress will be held at Philadelphia.

The largest technical session ever put on by the two A.I.M.E. divisions was held Wednesday afternoon when Sam Tour and Hugh E. Brown conducted a round table discussion on electrolytic polishing of metals, which will be reported in an early issue of THE IRON AGE.

The defense theme was emphasized by the featured speakers at the annual banquets and on Friday many delegates attended a meeting sponsored by the U. S. Ordnance Department, an educational session at which munitions production problems were discussed and manufacturers shown what shell parts look like.

While research, metallurgy and equipment are playing an important part in the steels that America needs for national defense, the quality of the industry's manpower is just as important, said C. M. White, vice-president, Republic Steel Corp., in an address before the Wire Association, Wednesday, Oct. 23.

"Steel production is a matter of tradition, skill and judgment," said Mr. White, citing the fact that instinct and experience of the men play a prominent role in the successful operation of an open hearth furnace and that there is no scientific instrument that will do the job for a heater, a roller or a wire drawer.

CONGRATULATES TWO of the new officers of the A.W.S. (left to right) Alfred E. Gibson, president, Wellman Engineering Co., Cleveland, is shown at the convention with David Arnott, new second vice-president of the A.W.S. and Col. Glen F. Jenks, president for 1940-1941. Courtesy Cleveland Plain-Dealer.

AT ANNUAL BANQUET of A.I.M.E.'s Two Divisions. (left to right) R. C. Allen, vice-president, Oglebay, Norton & Co., Cleveland, the banquet speaker, is shown with Donald Gillies, vice-president, Republic Steel Corp., and E. C. Knuth, chairman of the Cleveland Section of the A.I.M.E. Photo by courtesy Cleveland Plain-Dealer.

"The last war caught the steel industry right in the middle of a period of basic research and development," he said. "In those days, research work in our laboratories had shown many possibilities which had not yet been perfected. And what was true with steel was equally true with respect to airplanes, tanks and many other items of war and defense equipment.

"By 1935 we saw perfected and put on the market a whole range of steel alloys which were for the first time made available for broad industrial purposes in quantities and at prices which made their use practicable.

"By way of illustration—one example of the steels which came out of laboratories at this time was stainless steel strip suitable for stamping and forming operations. Not only straight chromium stainless—there was also produced chromium-nickel steel, and chromium-nickel steel made still more useful by the addition of molybdenum, titanium and columbium. This last element, known to the British as niobium, was only a curiosity just a few years ago. Today we are adding tellurium to stainless for improved machineability. We make it with silver for high corrosion resistance.

"I cite these examples simply to give you some idea about what is going on in this direction—and frankly, we see literally no limit to alloy steel possibilities.

"Practically every division of industry has benefited from new alloy steels especially adapted to special purposes. This has by no means been due entirely to steel metallurgy and laboratory experimentation. A great deal of it has been due to the development and practical application of better methods of production.

"Stainless steel wire for aircraft cables is an important item today. This has been made possible only because of consistent research development and equipment improvement in the steel industry.

"Not so many years ago automotive valve spring wire of the finest quality

could be obtained only from Norway. Today that wire is being made successfully in the United States.

"I don't have to tell any one of you about the increased productivity of modern wire-drawing equipment by comparison to that of a few years ago.

"In 1915 a die might finish a 300-lb. bundle within commercial tolerances—but beyond that its accuracy was uncertain. Today a die frequently does a good job for more than 40,000 lb. of steel wire.

"It is fortunate indeed that the steel companies of this country spent the money, the time, and the effort which they did in developing better steels for more of the peace-time purposes of this country. For in so doing they developed the very steels, and the equipment to make them, which are so urgently needed for purposes of national defense.

"In national defense production there can be no guesses as to the capacity of steels to live up to the demands made upon them. For instance, in a gun firing a long-range shell it is necessary to concentrate a terrific amount of power in a very small area. This requires the use of the strongest, toughest and most completely corrosion-resistant steel that can possibly be made, in order to hold up against the tremendous punishment which it has to take, in many cases, many times per minute. There simply cannot be any doubts about that steel. If that steel fails, our defense fails."

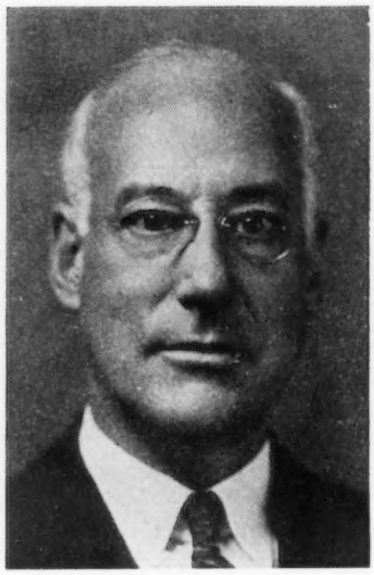
Mr. White pointed out that in engineering design the factor of safety is ordinarily computed as three or four times the estimated load. But in designing military equipment it is absolutely impossible to multiply the safety factor in this way, the reason being that weight can be added only at the expense of mobility and swift performance. Only by making absolutely certain of the quality of the steel used can the factor of safety be handled.

The speaker asserted that British tanks which successfully held off the Germans at Dunkerque were so closely engineered that projectiles hitting their armor plate would be stopped by the last ⅛ in. of steel. The men inside the tanks saw bulges form and turn red hot under the impact but knew that they were safe.

General Hugh S. Johnson, Scripps-Howard columnist, who was the speaker at the A.S.M. banquet Thursday night asserted that "the rising tidal wave of public sentiment that is sweeping Mr. Willkie to victory is composed of three elements. None has very much to do with the actual arguments of campaign speakers. One is a growing faith in the simple, homespun honesty of Mr. Willkie. The other is a growing failure."

The A.I.M.E. banquet Tuesday night, Oct. 22, was told that real progress has been made in building up the nation's reserves of strategic minerals. R. C. Allen, Oglebay-Norton & Co., Cleveland, who is consultant in the industrial materials division of the National Defense Advisory Commission, was the banquet speaker.

"We now have readily available to this country in industry stocks and government reserves, here and afloat, enough manganese for two years' consumption and enough tin for one year," said Mr. Allen. "The manganese figure takes into account increased production in Cuba, a better yield from domestic deposits and the substitution of low-grade domestic ore for high grade imported material in certain industrial uses. Our reserves of antimony, chrome ore, tungsten and quartz crystals, among the metals are beginning to accumulate. Large additional quantities of these and other minerals are being and will be purchased as rapidly as possible. We are working on salvage and reclamation programs, hoping we may never have to take



BRADLEY STOUGHTON, Dean Emeritus of Lehigh University, new vice-president of the A.S.M.

DR. OSCAR E. HARDER, Battelle Memorial Institute, Columbus, Ohio, new president of the A.S.M.

PRESENTATION of the Samuel Wylie Miller Memorial Medal to William Spraragen, technical secretary of the American Welding Society. (left to right) Dr. D. S. Jacobus; George T. Horton, retiring president of the A.W.S. and William Spraragen.

KLAUS L. HANSEN, first vice-president American Welding Society, 1940-1941.

ADOLPH W. MACHLET, president and treasurer, American Gas Furnace Co., Elizabeth, N. J., winner of the Sauveur Achievement Medal.

them out of the desk drawers but conscious that they may play an important part if it comes to a serious pinch."

Mr. Allen, who emphasized that he was not speaking in an official government capacity, asserted that mechanized warfare involves vast mineral supplies "including those fifteen industrial minerals we must import in large quantities from abroad, despite the fact that Great Britain and the United States control between them three-fourths of all the mineral resources of the world and the United States comes closer to complete self-sufficiency than any other nation."

Modern civilization is based upon utilization of mineral wealth, he said, and thus until there is some better distribution or better system of access to the world's natural wealth the "have not" nations may be expected to create trouble.

Among other speakers at the dinner were Dr. William E. Wickenden, president of Case School of Applied Science, who was toastmaster; Donald B. Gillies, vice-president of Republic Steel Corp., and E. M. Wise, International Nickel Co., Bayonne, N. J., chairman of the institute of metals division of the A.I.M.E.

The Mordica Memorial Lecture at the annual meeting of the Wire Association was presented by B. L. McCarthy, chief metallurgist, Wickwire Spencer Steel Co., Buffalo, speaking on "The Use of Plane Polarized Light and Sensitive Tint Illumination in the Analysis of the Micro-Structure of Steel." Two times in recent years Mr. McCarthy has been awarded the Wire Association's annual medal for the most meritorious paper In 1935 his contribution on grain size won the award and in 1937 his discussion of abnormal grain growth in the annealing of low carbon steel wire took the top honor.

In general, the exhibits at this year's show were better arranged, larger and more costly than ever. There was much brand new equipment. There was much emphasis upon armament items such as shell forgings, torpedo heads, bomb components, armor plate, aircraft parts, etc., a timely and entirely new trend.

Show high spots would probably include such developments as duPont's new brass plating process; the Sperry flaw detector for tubes; the Brush surface analyzer; Standard Steel Spring's Corronizing process; Electrolytic polishing by Rustless Iron & Steel Corp. and Carpenter Steel Co.; salt bath brazing by Ajax Furnace Co.; the exhibit of shaped tubing by the Dewey process in Republic Steel's booth; the Selas Co.'s radiometer exhibit; and the Continental furnace used in the new Capaco casting process, among other new developments. The display of electrolytic manganese attracted interest in view of the national defense efforts to make use of low grade domestic manganese ore. Brazing was featured on a larger scale this year, the display of aluminum brazing being well visited.

Latest welding and cutting practices and equipment were shown by 41 companies in the welding field, most of them featuring activated displays. There was a new Hi-Wave welder, automatic units, press type spot welders, new arc welding machines; the new Harris Calorific device for tuning in on the welder to check the work being done; a demonstration comparing cutting by different types of gases.

The American Gas Association's combined industrial gas exhibit featured 15 manufacturers. The high frequency electrical equipment field featured new equipment and "live" demonstrations.

The A.S.M. Sauveur award went to A. W. Machlet, president and treasurer of American Gas Furnace Co.,

(CONCLUDED ON PAGE 82)

RECEIVING LINCOLN Gold Medals at A.W.S. convention. (left to right) T. N. Armstrong, Jr., and H. J. French, the recipients; G. T. Horton; Prof. L. W. Clark.

The Scientific Method

ONLY a comparatively few years ago, one of the great achievements of the scientific method of investigation was the recognition of energy as an attribute of matter which was utterly beyond the reach of those who relied solely on observation and reasoning. This came from controlled quantitative experimentation, which ultimately became physical chemistry and thermodynamics. Before this happened, however, a huge accumulation of data and observations produced a chaotic condition in chemistry. Many able scientists attempted to develop the broad viewpoint but the true understanding of these matters was not obtained until Gibbs saw that reactions that occur in a single phase must be distinguished from those that occur between two or more phases. Furthermore, he concentrated on the state of affairs at equilibrium, where others had paid more attention to the reaction or change, and by a prodigious feat of abstract reasoning he showed that the conditions of equilibrium in all multiphase systems must conform to his simple phase rule.

About the same time certain other events, which are now recognized as being of the greatest significance to the development of scientific metallurgy, were recorded. First, and indubitably foremost was the introduction of metallic microscopy by Sorby, about 1860. It later became the most important single tool of the metallurgist and still holds that rating without competition. At the same time data were being accumulated in allied fields. Tschernoff had observed the "change point" in steel by 1869 and by crude though keen methods of observation he had even correlated it with the carbon content. This marked down the first line of the iron-carbon diagram. This study of the transformations of steel was materially advanced by Osmond with his microscopic work and by the use of Le Chatelier's thermocouple. Other experimenters worked similarly on nonferrous metals and alloys and by plotting the various freezing points against the alloy compositions they obtained the so-called "freezing point" diagrams. These depicted the effects of composition of freezing points and also gave additional thermal arrests, called "eutectics." Their diagrams were the crude forerunners of our present constitution or phase diagrams.

Engineers and physicists were also accumulating data on alloys and the interesting observation was made that the physical and mechanical properties varied with composition in a fashion that seemed to bear some relation to the freezing point diagram. Speculations on this point were supported by microscopical examinations. Metallurgists, needless to say, welcomed these new ideas and made effective use of them in their various technical pursuits.

Work along these lines was pursued in England, France, Germany, and elsewhere. All this activity brought out a huge mass of data, one of whose significant results was that a very confusing situation was created. To the practical man who was attempting to apply the new findings there were a number of things that were profoundly disturbing in this new metallurgy. One of the leaders of his day pointed out that the photomicrographs were hard to understand and he complained that they made out quenched steel to be akin to concrete, at which he was rightfully indignant and b e s i d e s, everyone knew it was not so. Furthermore they showed only an insignificantly small fraction of the whole piece and to be representative such photographs should be many hundreds of times larger, an accusation that is heard even today. Finally he protested that there were too many "ites" in steel, and the authorities themselves seemed to be in disagreement on them. While these objections might be dismissed as trivial, nevertheless the points were legitimate and brought out some of the minor difficulties encountered in placing metallurgy on a scientific basis. Of greater moment, however, was the inability at the time to understand and interpret the large accumulation of experimental data; thus to the scientist this confusion was far more keenly felt and created for him a typically intolerable situation.

At this stage of its development metallurgy was fortunate in having the stout backing of Roberts-Austen and we may say that poetic justice was again done when this gentleman's name was given to one of the best known constituents of the steels.

The freezing point diagram was used in a crude way to depict an alloy system and to correlate structures with the properties and with the behavior on casting, working, and heat treatment. In spite of the large amount of data, this work was made difficult on account of misconceptions of eutectics, double freezing points, and by the construction of the diagrams which ignored the all important single and double phase fields. It is easy to see now how impossible their situation was. In all this Roberts-Austen was the leader in the quest for the truth, the philosophy of which he summed up by saying: "It would seem that nature has enshrined in steel a series of her most complex secrets which we must discover as a condition of our successful use of it." It was in precisely such a frame of mind, we may presume, that he requested Roozeboom to contribute his ideas on the iron-carbon system and on a construction of the diagram which would conform to the doctrine of the phrase rule.

Following Dalton's atomic hypothesis it was generally assumed that atoms and molecules were arranged in crystals according to a fixed and repeating pattern. This is sometimes referred to as the Frankenheim-Bravais lattice. The definite and constant geometry of crystals and the fairly secure atomic hypothesis made this a reasonable assumption. The situation with metals was not quite as clear, though it was held that at least some of them were crystalline, the same as minerals. Other metals were held to become crystalline as a result of vibration and repeated pounding, hence presumably were previous-

in Metallurgy

By S. L. HOYT
Battelle Memorial Institute

Abstract of fifteenth Edward de Mille Campbell Memorial Lecture of The American Society for Metals: Herein the author reviews the growth of metallurgy and its present status, with particular emphasis on the mechanism of metallic deformation.

ly in some other condition. Curiously enough steel was once held to become amorphous at a red heat, as a necessary preparation for hardening on quenching. Out of these simple beginnings has developed the science of crystal structure.

The mathematical possibilities of handling the various ways in which atoms could be arranged in space to produce solid bodies were grasped at an early date. A formal statement appeared as the theory of space groups which listed 230 groupings in 32 major classes of the six crystal systems. The feature of these groupings was that each one was capable of filling space by parallel movements in three different directions. This theory was mathematically rigid and made it possible to treat crystal structure formally. Out of it came a whole system of crystallography of which it can be said that it was all possible theoretically and was inherently consistent, yet was all pure hypothecation.

For many years the work on crystal structure scarcely affected metallurgical thought. While the crystal symmetry of a few native metals was determined, it was not ordinarily possible to secure metallic crystals for the measurement of interfacial angles. Furthermore, the optical methods which were used with such success on transparent materials were not applicable to the opaque metals. In brief, no really effective tool was available.

On the other hand, metallographists soon became convinced that metals must be crystalline. This came from observations of dendritic growth of grains, Widmanstaetten figures, etching pits, and the like, and was consistent with the fixed freezing points of metals and the evolution of heat during solidification. The only results of important bearing on metallurgy were the observations of the crystalline nature of plastic deformation by Ewing and Rosenhain in England and Mügge in Germany. This work attracted only small attention at the time (about 1900), for the urgent problem then was that of the constitution of alloys. Furthermore, it was not possible to go beyond simple observation, except by speculation.

In establishing a theory of plastic deformation the first point to be settled is the precise mechanism of the movement or displacement of metal, yet it appears that too little attention has been paid to this point in recent years. Ewing and Rosenhain found, among several possibilities, that metals behave as though made up of a large number of minute blocks and that during deformation these blocks slip over one another in response to the applied stress. This sliding action did not sever the bonds between the blocks and after deformation the metal was apparently as sound as before. Directly following this original work Rosenhain applied a skillful technique to a further study of this problem. By protecting the surface of a sample which showed slip bands by coating it electrolytically with copper, and then sectioning it, he demonstrated the serrated "edge effect" that would be expected from the simple block movement just described. He also secured evidence of non-distortion of the blocks by showing that the same blocks, photographed before and after an increment of slip, showed no stereoscopic effect. In other words, his picture was simply that of a deck of cards with the edge of one card extending slightly beyond its neighbor. Supporting evidence of a simple block movement has been given a few times in the literature, and Andrade, for example, mentions the laying bare of a strip of the slip plane 0.1 mm. wide as one block slipped past its neighbor. This simple picture has survived throughout the intervening years and, with the assistance of models of deformed single crystals, it has become implanted in the minds of many as *the* mechanism of slip. Of course, the picture we have in mind of this process must be tremendously important to a theory and while I do not suggest that Rosenhain's picture is incorrect, it is assuredly not the only one and I shall point out later that a fundamentally different and more general mode of deformation has received too little attention, commensurate with its importance.

In the meantime, the searching methods of X-ray crystal analysis have been applied to the problem of plastic deformation and test pieces in single crystal form have been used to gain a simpler and more perfect portrayal of the fundamental phenomena. As a result, considerable information is now available on the stress-strain relationships and on planes and directions of slip. Actually the data have piled up like logs in a jam and the present situation corresponds to that in metallurgy at the time Roozeboom clarified the question of the constitution of alloys. The king log, in terms of an adequate theory of the metallic state,

has not been found and we do not yet know how to classify and order the data or how to interpret them in terms of general laws. By this I mean particularly that the precise atomic mechanisms of plastic deformation and strain hardening are not understood. Nevertheless many competent scientists have tackled these problems and it is significant that the metallurgist has given way to the physicist and metallurgical physicist. Our principal fear as metallurgists, is, I believe, that we may not be capable of following the reasoning or of grasping the significance of the results, though we may trust that some intermediary will arise to give us a simplified version of the theory. Consequently, it is with considerable diffidence that I venture to point out certain features that seem to require special attention.

On reading current contributions to the problem of plastic deformation it appears that a great need exists for close cooperation between metallurgists and physicists to develop a clear conception of just what it is that must be explained. Instead we find that one starts with one picture and another with a different one, yet each is covering the field and attempting to develop a general theory. The terminology also is highly confusing and various names are used to signify what is presumably one and the same thing. Thus, Ewing and Rosenhain showed with the microscope that "blocks" form and X-ray crystallographers have equally good evidence in their diffraction patterns that the grains develop "fragments." It is particularly confusing to have both discussed under those or other names without a clear indication of which is meant, or even whether the two are one and the same. I would propose as the first and highly desirable step, setting up a detailed and critical classification of the important phenomena. The object would be to bring everyone in agreement on what is and what is not known, and to suggest what is lacking and what points need special attention. Let us take an example which comes from the work mentioned on single crystals, and which is selected because it bears on our picture of the mechanism of the movement during plastic deformation and on our understanding of the related phenomena.

Single crystals of metals which have one slip plane, like the basal plane of the hexagonal close packed zinc, stretch out in tension as the slip planes tilt more and more into the direction of pull, until rupture occurs. At the same time the slip planes rotate in their own planes as the direction of slip in the basal planes lines up with the direction of the major shear stress. This gives the simple elemental picture of the geometric behavior of the slip plane and slip direction under the action of an applied stress. It becomes a little more complicated in metals whose structure permits slip on more than one plane. Thus the face centered cubic metals have four sets of slip planes, the octahedral planes. If two of these sets are symmetrical with the axis at the start, the crystal elongates by simultaneous slip on both sets, the details of which need not concern us here. If, however, the slip planes are oriented in some other way or at random, slip starts on only the one set which is most favorably oriented. The extension of the crystal tilts those planes and rotates them as was just described for zinc. Sooner or later, depending on the initial orientation, another set of octahedral planes must be brought into an orientation which is symmetrical with that of the "active" slip planes.

Let us see how that fits the picture of simple block movement. From the standpoint of mechanics the situation is the same as that for the initial orientation which has two sets of slip planes in symmetrical position, by which I mean that the resolved shear stress is the same on both sets of planes. While it will be anticipation, I should like to pose the question of what should happen at this point and require that the answer be given on the basis of the picture of simple block movement. Slip on the active planes has presumably strengthened them and we must argue that since no such movement has been going on on the second set, the latter must still be in a virgin condition and hence weaker than the first set. On this basis we would say that double slip would not occur at the symmetrical orientation, but at one for which the ratio of shear stress to resistance to slip is the same for both active and latent slip planes with the proviso that the latent slip planes still preserve their initial low strength. This deduction follows from Rosenhain's simple picture of the deck of cards movement. However, the situation is entirely different, for double slip starts when the second set of latent slip planes is approximately in the symmetrical position. Precise measurements show, in fact, that the latent slip planes which have supported no slip, in the usual sense, have been strengthened by some other though equally potent mechanism even more than were the active slip planes. This is a basic fact of plastic deformation and must be tremendously significant to those who attempt to develop a picture of plastic deformation. It is definitely inconsistent with a process which assumes no change whatever in the major portion of the crystal—the block proper—and which, therefore, cannot account for strengthening in directions or along planes which cut those blocks at an angle.

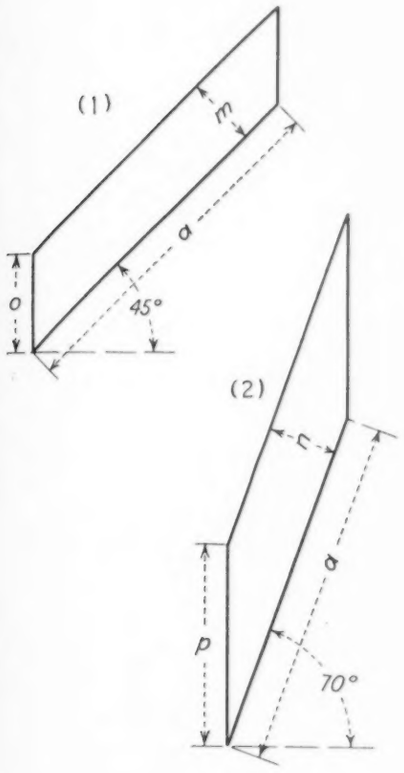
In addition to such difficulties of a purely theoretical nature, direct observation shows that metals deform and strengthen by a process which departs fundamentally from the deck-of-cards picture. This brings us to the pseudo-block movement which I described in 1926 for zinc crystals. As a part of the study there reported we attempted to check the picture of the simple block or deck-of-cards movement. A number of critical tests for the serrated "edge effect" were entirely negative. Slip bands were observed, it is true, but as close as could be observed the visible blocks distorted approximately the same as the crystal did as a whole. (See Fig. 1.) No trace of a serrated edge was found, though it would have been clearly visible. While this general situation has been discussed in great detail in the intervening years, I know of no reason to doubt the correctness of those observations. This gives two general pictures of the slip process, both of which appear to be well supported. My principal argument here is that the simple block movement is by no means the only one, and I suspect it is relatively the one of lesser importance. Possibly there may be a gradual transition from one type of movement to the other. At high temperatures the slipbands are far apart and the simple block movement is clearly in evidence; at lower temperatures more and more slip bands form and they increase in number as slip proceeds. As a suggestion it seems likely that block distortion sets in at some intermediate stage.

The pseudo-block movement obviates the difficulties in attempting to understand observations of single crystal behavior on the basis of a deck-of-cards movement, and places much less significance on the visible slip bands either as the major seat of slip or as the source of the strengthening effect. This is somewhat equivalent to saying that our usual methods of observing blocks and slip bands are not adequate to the task, an observation that I pass on to the aforementioned metallurgical physicists. Furthermore, while the slip process appears to be one involving the planes of a crystal, we should not lose sight of

the fact that the further the situation is studied the clearer it becomes that the slip direction is of primary, and the slip plane only of secondary importance.

One idea assumes that deformation breaks up initially sound grains into fragments which become disoriented and thus make the progress of slip more difficult. This is held not to be valid for metals which have several sets of slip planes, such as the face centered cubic. By appropriate combinations of slip (which we must assume would come about automatically) deformation could take place without producing any geometrical inconsistencies at the boundaries between fragments and therefore without increasing the resistance to slip. This being so, the strengthening effect would be left unexplained.

A second idea assumes that the metal crystal is initially a mosaic composite of slightly different orientations. It can be assumed that the interfaces carry the entire stress but this would not explain the increase of stress with strain. An alternate assumption might be that a block can support any stress system which does not have an effective stress component parallel to the slip planes, but this again would not hold for those metals which have more than one set of slip planes.

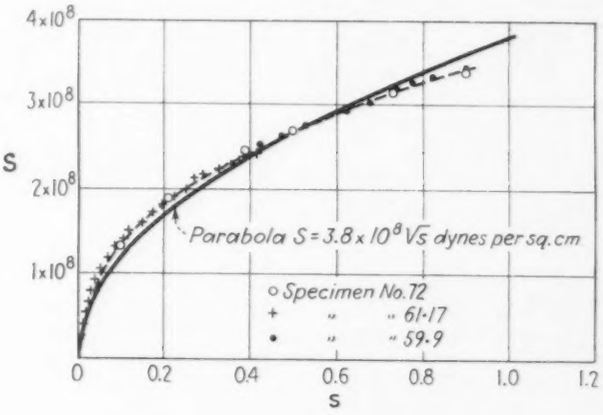


LEFT

FIG. 1 — Basal "block" of a zinc crystal. (1) In initial position. (2) In final position.

RIGHT

FIG. 2—Aluminum crystals.



According to the third idea, to quote Taylor, "A perfect crystal is supposed to be capable of withstanding a very large stress. The observed weakness of metal crystals is attributed to concentrations of stress due to internal surfaces of misfit or cracks, and the increasing strength with increasing plastic strain is attributed to an increase in the number of faults or cracks. As the number of such faults increases the ratio of maximum stress in the region of stress concentration to mean stress in the material would be expected to decrease. The mean stress necessary to cause a given maximum stress in a region of stress concentration must, therefore, increase as the number of faults per unit volume of the material increases."

Taylor accepts this third idea as the basis of his own theory of "dislocations," which name he uses for the faults or cracks just mentioned. Upon the application of a load or shear stress above the yield point a dislocation is created on one or more of the active slip planes which gives a local alteration of the positions of the atoms. The body of a block or fragment between two such slip planes supports the same shear stress as that at the interface, and it is a point of this postulate that the crystal is assumed to have a high natural strength. These dislocated atoms along the slip planes are the mechanical embodiment of stress concentrations. (See Fig. 2). By making certain plausible assumptions covering the rate at which the flaws increase in number with deformation, the effects of boundaries, and the effectiveness of the flaws, the calculated stress-strain diagram agrees well with the experimental data. This appears to be verified prediction but Masing, who has subjected this theory to criticism, states it as his opinion that this coincidence is illusory. Masing is well known for his work on internal stresses and their effects on the strength of metals, and he points out that such stress concentrations at faults are capable only of accounting for the Bauschinger effect, but not for an actual increase in the resistance to shear or true strengthening. What the cause might be of the formation of a dislocation is not stated, but at this stage of the theory, is of no particular importance. It would be of greater immediate importance to show (which is not done) how the dislocation theory is to be reconciled with the basic facts of plastic deformation. Presumably Taylor is discussing dislocations on the visible slip planes but we are bound to ask, for example, by what mechanism the visible blocks deform, how block distortion is to be understood in view of the assumption of great natural strength of the blocks, and how it is that latent slip planes become strengthened.

It may very well be impossible to picture the atomic mechanism of slip in terms of a mechanical analogy but microscopic and X-ray work shows that the picture of block or fragment formation, in some form, does appear to be legitimate. While there is no proof of it as yet, these structure elements also behave as though relatively strong, which might mean that they ultimately form of such a small size that they support the applied stresses by simple elastic distortions. This is consistent with X-ray evidence but before a theory can be held to be adequate it must also answer the old question of why the atoms do not simply and spontaneously revert to their normal positions without the need of resorting to elevated temperature treatments. Numerous facts of atom mobility suggest that the atoms should easily shift the slight amount required to produce straight rows or planes.

Engineers Focus Attention on Bessemer Steel

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RENEWED interest in bessemer steel was very much in evidence at the annual fall meeting of institute of metals division and the iron and steel division of the American Institute of Mining and Metallurgical Engineers, held last week in Cleveland in conjunction with the National Metal Congress and Exhibition. The fact that the bessemer process is independent of the scrap market was one reason put forth for the revival of interest in this oldest of steel making methods. Another possible reason, as pointed out by Dr. H. W. Graham, director of metallurgy and research, Jones & Laughlin Steel Corp., was the recent development of a method of controlling the bessemer blow by an arrangement of photo-electric cells and other instruments which elminates the human element in determining the important end point of a bessemer blow.

Dr. Graham expressed the opinion that, granted the necessary assistance of management, the only factor limiting the extent of revival in bessemer production is the rapidity and completeness with which management, operators and metallurgists can solve such manufacturing and quality problems as are involved. He felt that the decline of the bessemer process had gone somewhat further than was justified by present economic considerations and that these considerations will tend to sustain, and perhaps increase, bessemer output in coming years.

Dr. Graham's paper, "The Acid Bessemer Process of 1940," read at the Monday afternoon meeting of the iron and steel division, pointed out that in 1886 there were 10 times as much bessemer steel produced as open hearth, but in 1939 only 0.07 ton of bessemer steel was produced for every ton of open hearth steel. Fig. 1 shows the declining trend of bessemer output by decades from 1890 to 1940, while Table I gives detailed production data.

The small consumption of scrap in the bessemer process was stressed by Dr. Graham. "While even the most casual thinker realizes that the relationship of the bessemer and open hearth tonnages is influenced by the availability of steel scrap," he said, "few realize the extent of the domination of the scrap market upon this relationship, particularly upon the probable future of the bessemer process."

"Initially it would have been difficult for the steel industry to enter rapidly upon large tonnage production with any equipment other than a bessemer converter, independent as it is of steel scrap supplies. The bessemer process uses little scrap, say 5 to 15 per cent of the metallic charge, where the open hearth uses ordinarily some 50 to 60 per cent. The bloom butts, crop ends and other scrap incidental to steel works operation is the same for both processes, say 15 to 20 per cent."

"The bessemer process," Dr. Graham said, "is more than self-sufficient on scrap and produces a scrap as a by-product. The open hearth constantly uses more scrap than it produces and this deficit must be supplied by trade scrap originating from previously manufactured articles.

The increased use of steel, together with the development of such comparatively short lived steel products as automobiles and tin cans tended to increase the scrap supply and favored the expansion of open hearth production. But in the past decade conditions have changed and an increased supply of scrap can no longer be depended upon. The increase of per capita demand for steel has slowed down, Dr. Graham pointed out, and a reversal of the trend cannot be looked forward to with assurance. Nor can a further decrease in the useful life of steel, to turn products into scrap in a shorter time, be expected.

Because of these facts, Dr. Graham felt that trends in the history of the steel industry favoring an increased availability of scrap had run their course and had become progressively less effective. Consideration of this fact, he said, should justify earnest attention to an increased use of the bessemer converter as at least partial protection against the decreasing availability of scrap.

Discussing the control of the blow by use of a photo electric cell, a development pioneered and patented by J&L, Dr. Graham pointed out that this made possible for the first time in bessemer history to obtain, devoid of the human equation, an evaluation of the time factor at the end of the blow.

Another phase of bessemer production, that of dephosphorization, was covered in a paper read at the same session by Gordon M. Yocom, superintendent, Benwood plant, Wheeling Steel Corp. Mr. Yocom's paper, "A Method of Rapid Dephosphorization of Bessemer Steel," described a method of dephosphorization developed at the Benwood, West Va., plant which had been used there for the past three years in producing 250,000 tons of low phosphorus steel.

The inspiration for the development of this method was the difficulty experienced in meeting the demand for a steel of 0.025 P on one hand and the normal 0.09 to 0.1 P on the other, in face of the scarcity of the proper types of ore in the Lake Superior region. Ores of 0.015 P or less are shipped by only one or two mines and carry a high premium. An ore with 0.015 P, after reduction, with selected coke and limestone of low phosphorus content, may produce a pig iron of 0.035 to 0.04 P. The loss in weight after conversion in a bessemer converter may produce a steel of about 0.045 P.

"A low phosphorus steel is required in certain grades," Mr. Yocom said, "because phosphorus is an effective

hardener by solid solution effect on the ferrite and reduces the ductility of low carbon steel. It is generally found that each 0.01 per cent increases the yield point about 700 lb. per sq. in. At about 0.07 per cent P the adverse effect on ductility is such as to necessitate a reduction in carbon content. Tensile strength and elastic limit increase with phosphorus content. Resistance to impact increases up to 0.065 per cent P but above this figure decreases very rapidly."

"Phosphorus is present in iron and steel in the form of Fe_3P and is readily soluble in iron, but practically insoluble in slags. In order to remove phosphorus from iron it has to be oxidized. This is more readily done at low rather than high temperatures. Above 2400 deg. F., P_2O_5 is reduced by carbon, silicon and manganese if present. P_2O_5 is readily soluble in basic and practically insoluble in acid slags. The presence of 30 per cent silica is the upper limit at which slag will take up P_2O_5."

In the acid bessemer process a dephosphorizing treatment is best applied to the blow metal, which at that stage contains no silicon and very little carbon. The slag on the metal in the converter at the end of the blow contains over 50 per cent silica. This siliceous converter slag must be separated from the blow metal before a dephosphorizing treatment with basic materials is attempted. The process developed at the Benwood plant, Mr Yocom said, "was an inexpensive method for effecting this separation."

The Benwood dephosphorizing method requires a blow metal temperature in excess of normal for the purpose of melting a dephosphorizer added in the cold state. Slag fluidity is affected by excess temperatures and it was found that a silicon to manganese ratio of 2:1, coupled with young blowing, was a minimum requirement for the production of the desired slag, a thick viscous slag which can be held back in the converter while blow metal is being poured. It was stated that it is necessary to use an iron of high silicon content with the Benwood method of dephosphorizing. An iron with a Si-Mn ratio of 2½:1 was found to produce the best type of slag and in addition fitted into the iron ore situation. Bessemer iron furnaces are usually operated on three or four ores to produce an iron of normal phosphorus content at lowest cost. With this practice a Mn content of about 50 per cent is normal. At the Benwood plant this practice was followed but adjustments were made to Si and Mn contents to suit the needs for producing the desired type of converter slag. By controlling the Si-Mn ratio, a cross section of available ores may be used, rather than a selected few, and at the same time the proper type thick slag is obtained even with the higher blowing temperatures.

Discussing the Si content of the iron used with an unmelted dephosphorizing addition, Mr. Yocom said that it required an upward adjustment of about 25 per cent above the minimum of 1 per cent required for normal practice. An increase of 0.35 to 0.5 per cent Si is required on starting turns after the week-end shutdown.

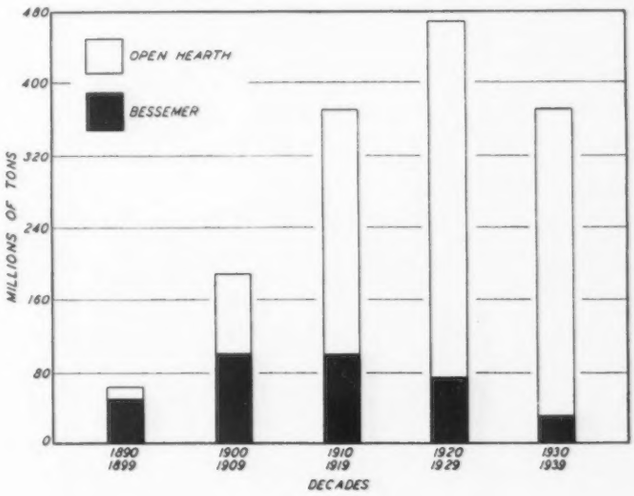

FIG. 1—Production of bessemer and open hearth steel by decades from 1890 to 1940.

Each blow is made up of a mixture of 40 to 50 per cent direct metal and 50 to 60 per cent cupola metal. The direct metal used analyzes 1.50 to 1.70 Si, 0.6 to 0.65 Mn, 0.085 to 0.095 P and 0.02 to 0.04 S. The cupola iron analyzes 1.15 to 1.25 Si, 0.45 to 0.55 Mn, 0.09 to 0.1 P and 0.055 to 0.065 S.

The cupola iron is desulphurized as required with soda ash. The charge to each converter does not vary more than a few points either way from a basis of 1.4 Si and 0.55 Mn, a ratio of 2.5:1.

The charge of iron is poured into the converter and after turning up to start the blow, the scrap is added. When making a heat of normal P content the average scrap charge is 1500 lb. for a 6.5-ton heat. When making the dephosphorized heat the scrap charge is reduced 1000 lb. to provide the excess metal temperature for melting the 500 lb. of dephosphorizing mixture, or 600 lb. for a 350-lb. dephosphorizing addition.

With the average iron of medium Si content, the blow is stopped from 3 to 4 sec. after the first change point, while with Si on the low side the blow is terminated immediately after the first change. When the Si runs on the high side, the blow is terminated about 6 sec. after the first change. The converter slags are always thick and viscous and show about 63 to 68 per cent SiO_2, 12 to 18 per cent FeO, 12 to 18 per cent MnO, 1 to 2 per cent Fe_2O_3 and 2 to 3 per cent Al_2O_3.

After the converter is turned down a block of wood, attached to a long rod, is inserted in the nose of the vessel. The block is 4 x 4 in. square and slightly longer than the distance across the nose at a point a few inches above the pouring lip. A light rod is attached to the block at an angle sufficient to allow the slag man to stand to one side to avoid the heat. The lip is built up to a U shape to provide a shoulder for each end of the block to rest on. When the converter is lowered to pour, the block prevents the slag from entering the ladle but does not hinder the pouring.

Having thus separated the slag and the metal, the dephosphorization proceeds very rapidly and uniformly from heat to heat without delays or interruptions, Mr. Yocom claimed. The dephosphorizing material is added to the metal stream as the iron is being poured from the converter to the ladle. This mixture consists of 50 per cent impure lime, 30 per cent dried roll scale and 20 per cent dried flux. This mixture is added in the cold state and when melted together to form a slag shows the following analysis: 48 per cent CaO, 28 per cent Fe_2O_3, 7 per cent SiO_2 and 7 per cent Al_2O_3.

The dry mixture is held in a hopper and enters the metal stream via a pipe chute at a rate controllable by a

(CONCLUDED ON PAGE 83)

Welders Debate Year's Progress

IN a program covering five days of simultaneous technical sessions and the presentation of over 50 papers, it is impossible in these few pages to give in abstract form more than a sampling of some of the ideas presented at the 1940 annual meeting of the American Welding Society at Cleveland. Almost half the papers described progress in fundamental research on welding. Papers on practical phases of welding had little direct reference to the defense program except a group of ones relating to spot welding aluminum alloys and gas welding tubing in the aircraft industry. The lead-off paper on welding in shipbuilding did not refer to navy work and of the two papers presented by representatives of the Navy Department one related to the huge program of increasing shore facilities, many of which will have welded rigid frame structures, and the other to piping.

Other subjects included on the program were welding of structures, bridges, railway passenger and tank cars, piping, flame cutting, flame hardening, flame cleaning, various spot welding techniques, and problems of equipment design, electro-brazing and operator training.

—Over 25 papers devoted to fundamental research. Others deal with ship and bridge welding, flame hardening, electro-brazing, etc.

Welding in Shipbuilding

PRACTICALLY all vessels under 300 ft. in length, such as small tankers, barges, towboats, etc., now building to A.B.S. classification are of welded construction, according to a very complete analysis given by David Arnott, vice-president and chief surveyor, American Bureau of Shipping. Of the larger ocean going vessels now building to A.B.S. classification, on Sept. 1, 1940, out of a total of 177, 41 are all-welded and 135 part welded. Only one large car ferry can be termed a riveted vessel.

So far as barges are concerned, there is a decided saving in initial costs for the welded barge as compared with the riveted barge of the same type. The comparative cost of riveting and welding in the case of the larger ocean going type ships is largely dependent on the facilities available. The cost of the welded ship will, however, tend to reduce as time goes on and as experience is gained in ship welding, Mr. Arnott said. Our shipyards are continuously experimenting with various types of automatic equipment, which tend to lower costs.

Bridge Welding

ONLY a few small bridges of welded construction have been built in this country. Fred L. Plummer, research engineer, Hammond Iron Works, questioned why this condition prevails and reviewed some practice abroad. During the past several years, Germany has built 150 railway and 500 highway bridges of welded construction, all but two of which have given perfect service. Experience of the Germans would indicate that: (1) heating effects should be minimized; (2) plate thicker than 2 in. should not be used, and (3) T-shaped rolled flanges should be used to avoid the shrinkage effect due to web-to-flange welds.

Bridge welding has been applied extensively also in Belgium. In this country, welding has been used principally for the fabrication of auxiliary parts of bridges, but there are two rigid flame bridges in the Cleveland area that are welded. Mr. Plummer beljeves the fabrication by welding of some bridge structures is fully justified, but stresses the point that all parties concerned must first inform themselves as to the technical, economical and practical problems that must be solved if welded fabrication is to be generally accepted for bridge structures, and secondly must cooperate to secure adequate solution of these problems.

Welded Structures

WELDED construction of steel frame buildings is definitely accepted, yet very few structural shops are as yet equipped adequately and organized properly to realize full economy from welding, according to LaMotte Grover, structural welding engineer, Air Reduction Sales Co. Efficiently and carefully controlled organization of shop and field operations preceding welding, as well as carefully planned programs of the welding, are of paramount importance for both reliability and economy, he said. All operations should be in charge of someone with a thorough knowledge of welded fabrication. For this reason, it is often expedient to train men within the plant organization for welding supervisors.

Flame Hardening Techniques

A NUMBER of interesting points on the production flame hardening of machine parts were brought out in a paper presented by John Erler and P. H. Tomlinson of the Farrel-Birmingham Co. The company is flame hardening steel forgings and rolled stock of plain carbon steel of 0.35 to 0.70 per cent C, also high alloy, air hardening steels as well as Meehanite, a pearlitic cast iron. The authors stat-

(CONTINUED ON PAGE 84)

In vertical Milling Machines also, rigidity originates in the column — the backbone of the machine—and determines the productive capacity of the machine more than any one other factor.

Note how carefully the column of a Milwaukee Vertical Milling Machine has been engineered for the proper distribution of metal — an inside horizontal wall divides it into a double box section, the cross mounting of the motor permits a solid rear wall, which, together with the solid front face, assures an unusually rigid structure.

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On The Assembly Line

BY W. F. SHERMAN
Detroit Editor

• Mass production of a midget truck for the Army indicated by negotiations now in progress . . . Aviation plant expansion may be brought temporarily to a halt to avoid possibility of mushroom growth . . . Parts manufacture to be increased

DETROIT—It appears that an order for mass production of a new type midget Army truck for transport and combat work is in the offing, but is being delayed temporarily by a battle between two or three motor car manufacturers, each of whom is seeking the order, or part of it. The truck is understood to be similar to the midget vehicle pictured in THE IRON AGE on Oct. 17 and described briefly in the issue of Oct. 10.

Volume production of these vehicles up to total of 50,000 or more is indicated, but current inquiries limit the initial order to a probable 500. Originally it was assumed that the company which produced the design and launched inquiries for parts and equipment would get the order. This was American Bantam Car Co. of Butler, Pa.; however, latest reports have it that another of the independent manufacturers and one of the Big Three are also angling for orders. Automotive circles have heard that the Army is anxious to get a fleet of these cars for field work and might, therefore, possibly place duplicate orders to speed deliveries. As regards capacity to produce up to the maximum figure mentioned so far, the Bantam machine tool equipment appears to be adequate, although retooling would be a necessity, since the design is not the same as the Bantam passenger car.

May Aid Light-weight Cars

FROM a peacetime automotive viewpoint the most intriguing suggestion derived from preliminary information about this lightweight vehicle is the possibility that light-weight cars for general use may be accelerated in their development as a result of practical experience which the Army and manufacturers may gain if large numbers of this kind of truck are put on the road. Success of the midget vehicle under severe field conditions may prove the incentive for the manufacture, later on, of a type of passenger car and commercial delivery vehicle which the industry has not managed to produce before this time.

It is a matter of observation and general agreement in the automobile industry that engineers have advanced design technique to the point where, by use of the most modern materials, they could produce some astonishing light-weight vehicles (and not necessarily midget cars) when management and sales forces are convinced of the practicability and desirability of swinging far from today's conventional designs.

While plans for carrying out the scheduled subordination of 1942 model changes are being put in shape by the Automobile Manufacturers Association, the industry still is frankly questioning about its future course. It is not easy to see beyond Jan. 1 in figuring out just what will be done to obtain equipment that will be made necessary by model changes, even minor ones. Nor is it easy to figure out just what the industry will do for materials when late spring rolls around. The combination of draft, Army enlistments and labor demands which will be made by defense industries also creates some problem of manpower. Already a technical manpower survey is under way. In other words, it is now Men, Machines and Materials, as never before. This is the industry's M-day!

A month ago, in Detroit, Raoul E. Desvernine, president of Crucible Steel Co. of America, made it plain that electric furnace alloys undoubtedly would not be available for the automobile industry's use next year. Tool steels and die steels, it was indicated by Mr. Desvernine, would be most critically in demand. He said then, prophetically, that the only solution would be to reduce model changes to a minimum, adding "Knudsen knows this better than anyone." Mr. Knudsen is steering his way through this problem and guiding the automobile industry.

Incidentally, the aircraft industry is being scheduled for a breathing spell by Knudsen. He stated here a short time ago that a tour of almost every aircraft and engine plant in the country had convinced him that aviation plant expansion must be brought temporarily to a halt while this industry puts all of its new facilities into shape for maximum production. He said that agreements had been reached then setting definite limits on plant expansion for all of the airplane manufacturers and that similar agreements were pending for engine builders. Thus, he said, each plane and engine plant would have a stated goal in terms of building size, equipment and, most important, production. He indicated at that time that parts manufacture would be increasingly on a sub-contract basis. The inference exists that size is a critical factor in the plants of the aircraft industry and that over-expansion of individual units might make them unwieldy so the point of maximum yield (productivity) would be over-reached.

To Avoid Mushroom Airplane Expansion

THIS is part of the theory behind the erection of entirely new plants like the one for the airplane engine division of Ford Motor Co. at the Rouge plant, also the plane engine plant which is being started near Cincinnati. Through this method proved designs (the

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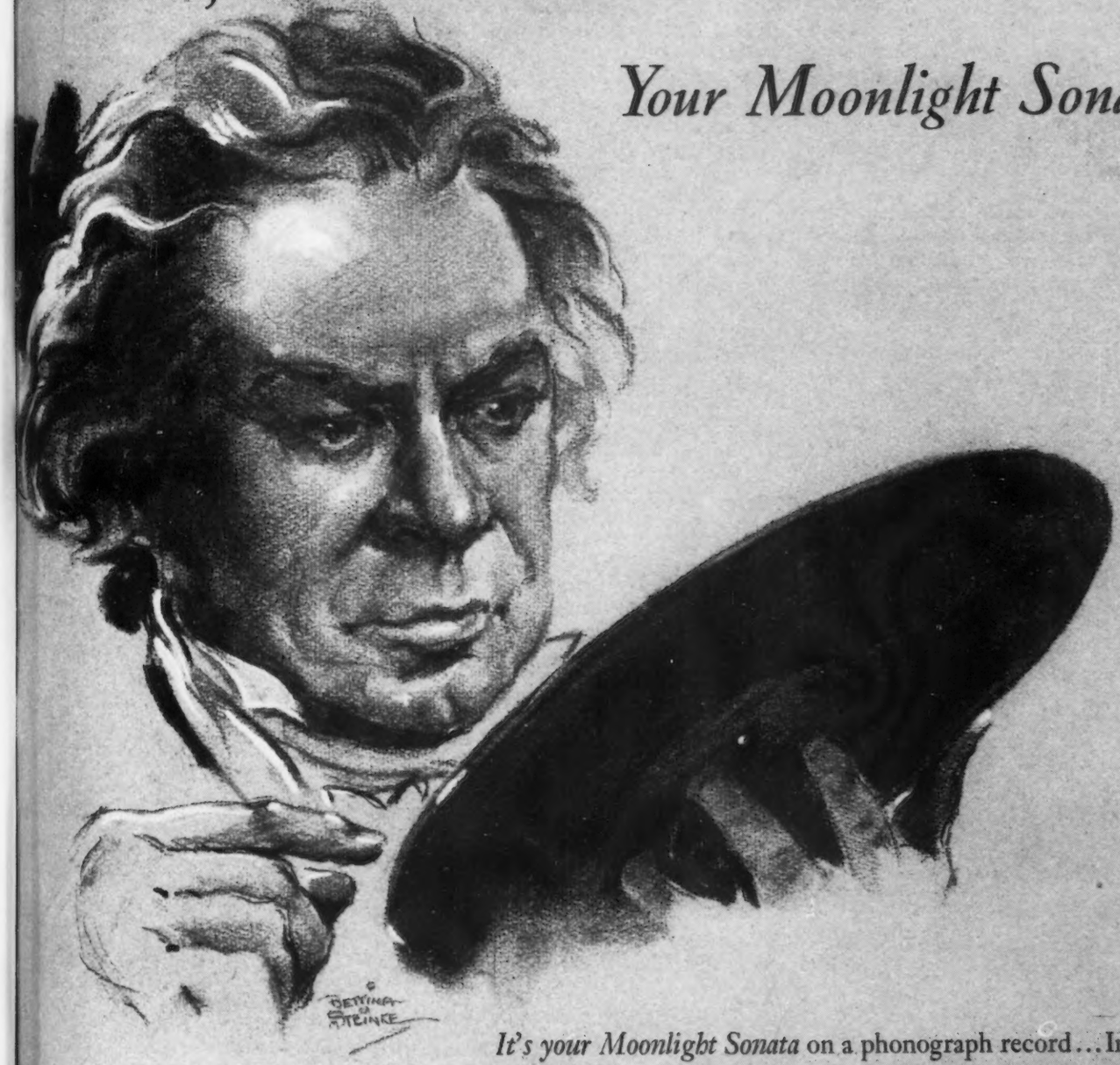

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It's your Moonlight Sonata on a phonograph record... In these fine grooves are recorded the sound vibrations produced as the sonata was played. A needle connected with a sensitive diaphragm reproduces these sound waves.

Miraculous? Why, no . . . it's very simple. You see, it's done by machines that record the sound waves, produce the records in huge quantities, and with them reproduce the sounds in phonographs throughout the world.

No, they're not expensive. Production is standardized through the use of very accurate basic machines . . . jig borers, lathes, drills, millers, shapers, grinders, and so on. That is how we get "tenth of a thousandth of an inch accuracy."

Impossible to do these things by hand? You're right!

Accuracy

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Pratt & Whitney and Wright engines) will be put into production in new plants with separate staffs operating them, thus avoiding a mushroom growth of the parent plants where these two engines have been manufactured in the past.

It is improbable that automotive horsepower and maximum speeds will be increased much further, according to D. U. Bathrick, vice-president and general sales manager of Pontiac, who predicts that both horsepower and maximum speeds of current models probably will be "frozen" at present levels until better roads are available.

"Present power specifications are likely to remain until roads are constructed to handle speed ranges over 90 miles an hour," Bathrick declared. ". . . Some cars this year have maximum speeds which even a professional cannot handle on present-day roads. We don't think fast enough to drive a car 100 miles an hour."

Completing seven years as president and general manager of Pontiac, H. J. Klingler last week was honored at the Chicago Automobile Show. Klingler has guided his division through a period of increasing production each year from 76,553 in 1934 to 217,000 for the 1940 model year just closed. The year he came with the plant the foundry was reopened with new equipment and during the past summer two new cupolas were added and foundry capacity was increased 50 per cent. In 1936 a $3,000,000 axle department was installed under his direction. A year ago the final assembly line was replaced by an entirely new line.

Entrance of the Nash into the low priced field has brought up the question of just where it stands in relation to other cars, pricewise. The following tabulation indicates its standing. Prices are those announced at factories for cars with standard equipment and Federal taxes paid, except Ford:

Chevrolet Master Deluxe, $764; Chevrolet Special Deluxe, $844; Ford Deluxe, $735, Federal tax to be added; Ford Super Deluxe, $811, Federal tax to be added; Nash Special 600, $723; Nash Deluxe 600, $816; Plymouth, $736; Plymouth Deluxe, $776; Plymouth Special Deluxe, $837; Studebaker Champion Custom, $729; Studebaker Champion Deluxe, $759; Studebaker Champion Deluxe-Tone, $794.

Thus it can be seen that while automotive volume still makes it necessary to refer to the Big Three as the important ones, the price setup makes it necessary to refer to the Big Five or, perhaps, the Big Six because Willys, with a starting price of about $665, might also go in the above list.

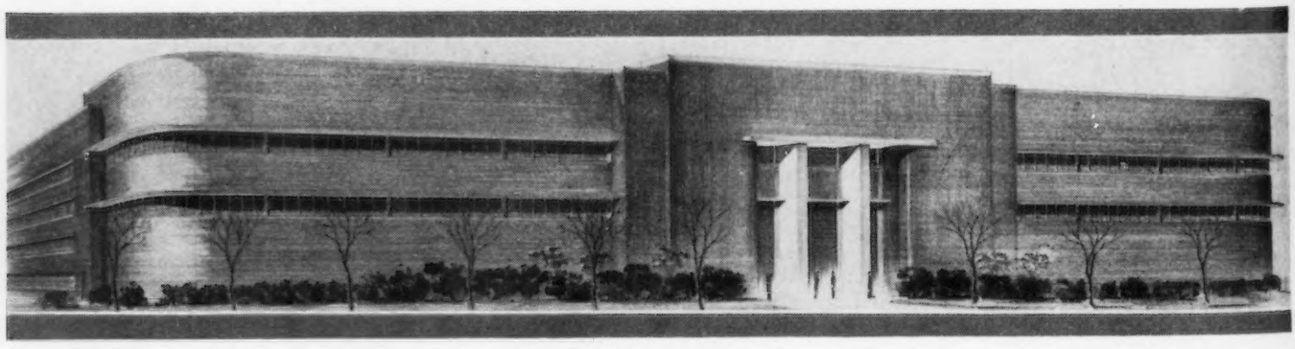
The listing of prices calls attention to the fact that automobile sales forces have given up the "Standard" models in favor of "Deluxe" or some other fancy term. For instance, Chevrolet now has a standard model that goes under the name the Master Deluxe, and Ford starts right out in the listing with a "Deluxe" model.

The eleventh consecutive weekly gain in automobile production occurred during the past week, setting a new high for 1940 and approaching the peak reached in July, 1937. Ward's Automotive Reports places output for last week at 117,080 passenger cars and trucks compared with 114,672 in the previous week and 78,210 in the corresponding week of 1939.

HOW PLANE ENGINE PLANT will look when finished. The new $11,000,000 airplane engine building now under construction at the Ford Rouge plant is probably America's first building designed for blackout. A new type of window construction with "eyebrows" over each pane of glass will be used to control visibility of the plant from the air at night. The building, 360 x 1000 ft., will contain 800,000 sq. ft. of floor space. It is scheduled for completion about March 1, 1941. Four thousand Pratt & Whitney engines will be built there by Ford for the Army. They will be the 2000-hp. 18-cylinder air-coled Double Wasp engines. The plant, with $7,000,000 worth of equipment, will turn out one engine each hour during a 16-hr. day. Ten thousand skilled mechanics will operate it.

Cincinnati

• • • **Ground was broken** last Wednesday at Lockland, Ohio, for construction of a new plant by the Wright Aeronautical Corp. The proposed building is said to be the biggest single industrial unit to be started so far in the national defense program. Guy W. Vaughan of New York, president of the Curtiss-Wright Corp., began the proceedings when he set in motion a huge tractor bulldozer at the impressive ceremony. It is estimated that the plant will be 60 per cent bigger than the 1,000,000 sq. ft. of floor space originally planned, and will cost $37,000,000 or $5,000,000 higher than previous estimates. These figures were given by Mr. Vaughan and Emil Schram, chairman of the Reconstruction Finance Corp. who attended the ceremonies. Orders for approximately $20,000,000 worth of machine tools and equipment have been placed for this new plant, some of which have been ordered from Cincinnati producers.



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Washington

BY L. W. MOFFETT
Washington Editor

• Widespread use of President's priority system order remains a question . . . Complaints are made that commercial steel buyers exert unnecessary pressure for deliveries . . . Lack of understanding by government agencies considered a factor

WASHINGTON—The President's order issued late last Tuesday setting up a priority system over all private industry for national defense production came earlier than had been generally expected. The action was based on a recommendation of the National Defense Advisory Commission. That such an order was to be forthcoming sooner or later had been predicted. It was the opinion, however, that the voluntary preference system was to be continued exclusively for some time. This view was based on the statement by the President about two weeks ago that he hoped a priority order would not be necessary. It is the first time in the country's peacetime history that such an order was ever issued. It was promulgated under a special law of June 28. It authorizes the President to command industry to give defense requirements preference over either commercial or export demands. Whether or not so-called bottlenecks have developed which made the order necessary has not been disclosed.

In steel apparently the tightest immediate spot concerns or soon will relate to structural steel for new or expanded plant facilities and housing, and possibly demands for shell steel. The pressing demand for machine tools, many believe, was an outstanding reason for the order. It still remains a question whether the priority order will be used freely.

Priorities Board Is Organized

Simultaneously with issuance of the order the President established within the National Defense Advisory Commission a Priorities Division headed by Procurement Coordinator Donald M. Nelson and a Priorities Board headed by William S. Knudsen. Other members of the board are Edward R. Stettinius, Jr., and Leon Henderson. Hardly had the division been created when Administrator of Priorities Nelson announced in a statement that the "new priorities administration does not mean that a system of mandatory priorities on all national defense contracts will be instituted immediately." He added that it is the intention that the system of voluntary preference shall be continued. At its first meeting the Priorities Board last Thursday formally announced approval of the voluntary system and said it would be continued "as far as it is practicable."

The commission, he pointed out, had recommended establishment of a priorities board and an administrator of priorities because the defense commission anticipated an increasing demand for governmental assistance to assure the prompt delivery of items required for the defense program. He added:

"The setting up, at present, of adequate machinery for handling the priority question will be an important aid in preventing industrial confusion, particularly as the program broadens. It will thus be a useful contribution to the national defense effort.

"The immediate tasks of the priorities board and the administrator of priorities will be:

"1. To establish policies governing operation of the priorities system.

"2. To adjust differences that cannot be settled by contractors themselves dealing through procurement officers of the War and Navy Departments and the Priorities Committee of the Army and Navy Munitions Board.

"3. To handle such priority problems as may arise outside the jurisdiction of the Priorities Committee of the Army and Navy Munitions Board."

Mr. Nelson will determine and invoke the priorities, while the actual fixing of them will be done by the new board. The executive order authorizes the President to require all companies having Army-Navy contracts "to grant priority for deliveries pursuant thereto over all deliveries for private account or for export."

Machine Tool Industry Cited

The opinion that the pressure for machine tool deliveries may have been one of the chief reasons for issuing the order arises from a statement made by the President. In his recently expressed hope that a priority order would not be necessary he qualified his remarks with the comment that the current situation respecting the machine tool industry might require such an order. He explained that there were long-standing machine tool contracts which might not be susceptible of handling under the export license system.

The law authorizing the President to establish priorities is extremely broad. Under it embargoes can be applied against exports of any kind to a single country or to all countries, or to one country and not another. Thus the system could effectuate more rapidly a ban on shipments abroad than is being done under the licensing system. Domestically, the law authorizes displacement of commercial orders or even their cancellation, with proper compensation. It is a question whether a manufacturer in peace-time, complying with a priority order, might not be sued for nonfulfillment of contract should the government demand cancellation or delay in delivery of commercial orders.

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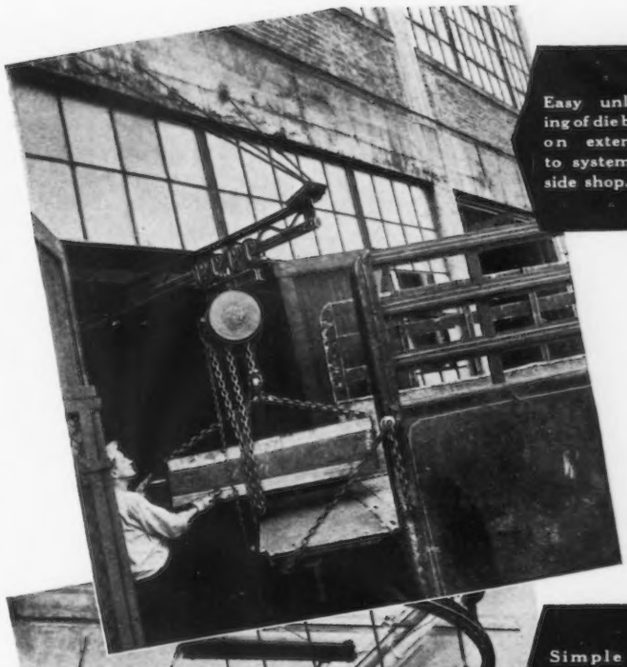
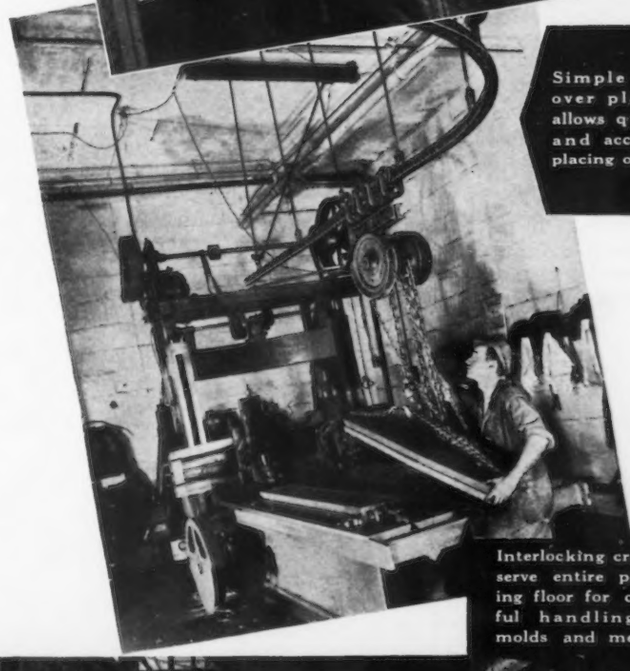


Easy unloading of die block on extension to system inside shop.



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be felt by the steel industry. At the present time the predominate pressure for deliveries continues to emanate from commercial sources and delivery has completely obscured price as a competitive factor.

Preference System Confusing

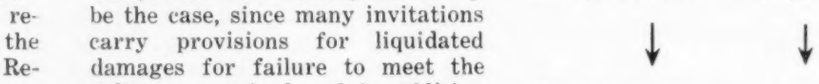
The priority order was issued amidst confusion which prevailed regarding the meaning, import and operation of the voluntary preference system which the defense commission had established. Interest now is being manifested regarding possible changes in the defense steel buying policy. Reports from the steel industry are that the cause for the confusion arose from an apparent lack of understanding on the part of the government purchasing offices and not on the part of industry. At the same time complaint has been made that commercial buyers have pressed for deliveries that could well be held off.

It was pointed out in the commission's original release on Aug. 12 that "each government contract or order will also carry a desired date of delivery and delivery date is the prime consideration."

In spite of this requirement, many government purchasing offices have been issuing invitations subject to a preference classification in which no delivery was stated or requested. Delivery apparently has been left up to industry with the thought that the statement of a preference classification was sufficient to push the work called for by the invitation ahead of everything else on the schedule. This, it has been stated, can hardly be the case, since many invitations carry provisions for liquidated damages for failure to meet the delivery promised and in addition it was assumed that the government would not abuse a system which rests upon voluntary cooperation by asking for a delivery in advance of actual need.

Cited as further evidence of the lack of understanding on the part of government offices of the working of the voluntary preference system was the recent receipt by a member of the steel industry of a notice of an A1 preference rating to an order which had been shipped complete two weeks before the notice was received.

The view is general that a voluntary system is the most desirable and there is no doubt of the steel industry's ability and desire to cooperate. It would be well, however, it has been insisted, if the government purchasing offices were always to specify a delivery date and make a conscious effort not to specify a date ahead of actual need. The voluntary system, it has been urged, requires that the government, as well as industry, cooperate.



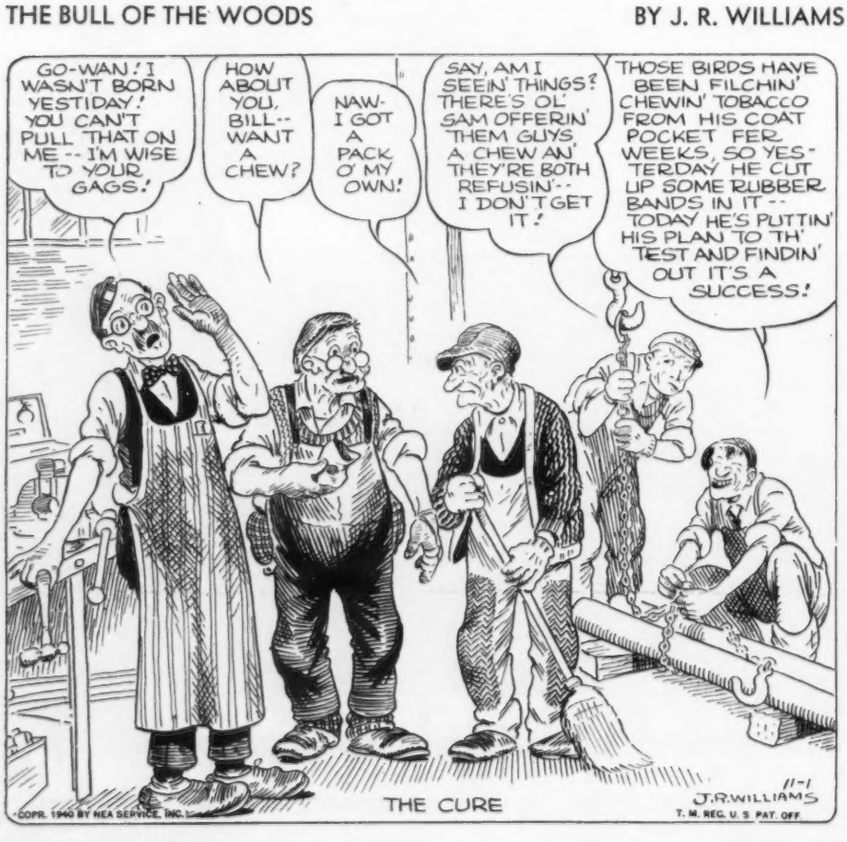
Washington

• • • **Meeting last** Thursday for the first time since it was established by executive order, the Priorities Board of the National Defense Advisory Commission approved the system of voluntary preference ratings on national defense contracts and adopted a policy of continuing this system "as far as is practicable." The board said that it had been established upon recommendation of the defense commission, "which felt that there was a growing demand on the part of industry for governmental assistance in settling conflicts arising from the impact of the defense program, especially in those areas where a large proportion of productive capacity is engaged in defense work."

The administrator of priorities will carry out the policies of the board to resolve such conflicts. He will make the necessary contacts with industry and with government departments and will determine what activities of governmental agencies are consistent with established policies of the board. To assist the administrator, the board named A.C.C. Hill, Jr., assistant to the coordinator of national defense purchases, as acting deputy administrator.

It approved a plan of organization, adopted a number of policies, endorsed previous activities of the Priorities Committee of the Army and Navy Munitions Board and directed the drawing up of rules and regulations governing action by the board and the administrator of priorities for reference to the President for his approval.

THE BULL OF THE WOODS — BY J. R. WILLIAMS


GO-WAN! I WASN'T BORN YESTIDAY! YOU CAN'T PULL THAT ON ME -- I'M WISE TO YOUR GAGS!
HOW ABOUT YOU, BILL-- WANT A CHEW?
NAW- I GOT A PACK O' MY OWN!
SAY, AM I SEEIN' THINGS? THERE'S OL' SAM OFFERIN' THEM GUYS A CHEW AN' THEY'RE BOTH REFUSIN'-- I DON'T GET IT!
THOSE BIRDS HAVE BEEN FILCHIN' CHEWIN' TOBACCO FROM HIS COAT POCKET FER WEEKS, SO YESTERDAY HE CUT UP SOME RUBBER BANDS IN IT -- TODAY HE'S PUTTIN' HIS PLAN TO TH' TEST AND FINDIN' OUT IT'S A SUCCESS!
11-1
J.R.WILLIAMS
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T. M. REG. U. S. PAT. OFF.

THE CURE

The duties of the Priorities Committee of the Army and Navy Munitions Board will be to control the placing of preference ratings on Army and Navy contracts and resolve any conflicts that may arise between the two services. Preference ratings serve as indications to manufacturers of the order in which defense contracts placed by the Army and Navy are to be filled to meet the requirement of the national defense program.

Other policies adopted by the board were announced as follows:

1. Delivery dates requested by the Army and Navy on preference-rated contracts should be geared, through proper scheduling, to deliveries of related defense items. Thus, all components of tanks, such as radios and machine-guns, will bear the same priority rating as the completed tank, the delivery dates being so arranged that all components will flow to the assembly point at the proper time.

2. Preference ratings covering all the supply requirements of a specific industry or company within an industry should not be extended at the present time. The board felt that extension of such blanket ratings is not required and decided to continue for the present the practice of applying preference ratings to individual contracts.

3. The preference rating AA, which has not been used so far and which would require immediate precedence over all other contracts, private or government, should be reserved for cases of exceptional emergency and before its use reference should be made to the priorities board for policy decision.

4. With the advice of the machine tool section of the defense commission, the Priorities Committee of the Army and Navy Munitions Board should continue to extend preference ratings to orders for machine tools placed by other machine tool builders. It was explained that machine tool builders frequently must purchase their own machine tools from other producers. Unless such extension of preference ratings were permitted, it would be impossible for primary machine tool builders to increase their production in order to meet the demands of the defense program.

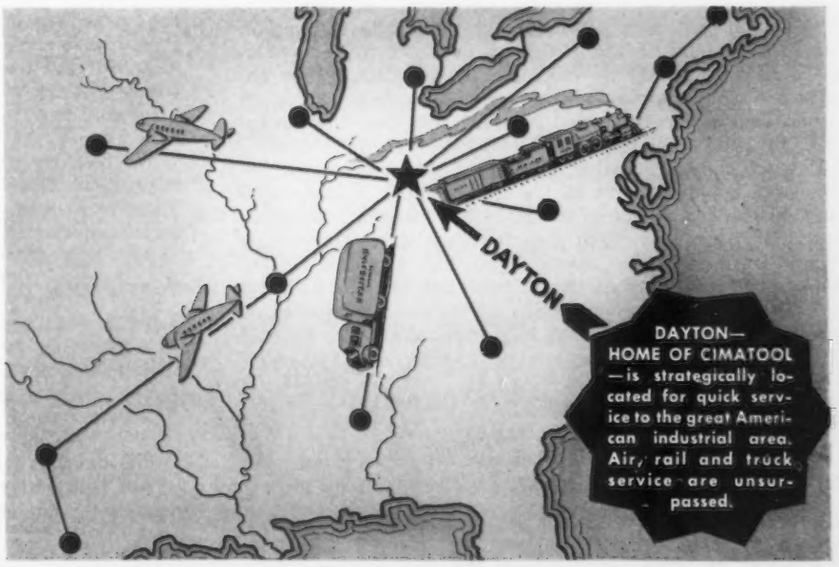
STRATEGICALLY LOCATED— ABLY STAFFED

CIMATOOL DESIGN SERVICE FOR DIES AND TOOLS

A New Plant— thoroughly modern, with all facilities—a staff which specializes in design and fabrication of machine tools, dies, fixtures, tooling, special and single purpose machinery, and tooling programs—strategic location close to the weight of American industry.

The Cimatool staff is thoroughly experienced in a wide variety of all types of tooling and is equipped to handle design only, or design and build programs.

We invite you to visit us or write for specific information.


DAYTON
DAYTON—
HOME OF CIMATOOL
—is strategically located for quick service to the great American industrial area. Air, rail and truck service are unsurpassed.

Cimatool

THE CIMATOOL COMPANY

Dayton, Ohio, U.S.A.

DIEMAKERS • • TOOL MAKERS

MACHINE TOOLS

Fatigue Cracks

BY A.H.DIX

Love Interest

• • • A colored gentleman called at the Cleveland office recently and told Miss Ruth Walker, right-hand girl to Emerson Findley, our Cleveland manager, *"My boss wants that story you had about the sweetheart."*

Batting her blue eyes and thinking fast, she reached for the Sept. 26 issue, turned to the editorial, *"The Girl He Left Behind Him,"* and said, "Is that it?" It was.

Pun

• • • Speaking of headlines, one of the best we have seen lately appeared in the Cleveland Plain Dealer in connection with the story about the joint navy conference between Hitler and Laval. Photographs of the two were headed, *". . . Of Ships and Shoes and Sealing Pacts."*

Goodbye, Trylon

• • • The night the thermometer cracked through the 32 deg. line, we paid our farewell visit to the World's Fair. After watching the eurythmic Eleanor Holm and her fellow Aquacadians gooseflesh their way through their numbers and the lady in trunks at the Dali exhibit stay underwater for a suffocating length of time, we tore ourselves away from the whitemeat belt and returned to our true love, the industrial exhibits.

They were, it seems to us, the very heart of the Fair and the part that will live longest in memory. Although a financial flop, the Fair was undoubtedly an esthetic and cultural success, despite large areas of dullness. This was due, of course, to inadequate "editing." The dull exhibits should have been blue-pencilled out before they began.

How you can turn down an exhibitor who is long on money and short on knowledge of populace pulse-raisers, we don't know. All we can do is to pass along the observation that people have a yen for seeing wheels go 'round and a lively curiosity about the way the things they buy are made.

Every exhibitor, within reason, should have been required to devote a part of his space, and a considerable part, to the actual manufacture of his product. Interest, we noticed, was keenest at those exhibits that showed how things are made—tires, steel, rayon, hub caps, and so on. We saw a young man at the USSteel exhibit hold a crowd enthralled with a demonstration of the heat treatment of springs, proving, as someone said, that there are no dull subjects, only dull teachers.

Stopper

• • • *How Allis-Chalmers Texrope Brings Home the Bacon for 3200 Hungry Mink!*

Take it or Leave it

• • • The plural that has always puzzled us is "pants." We have always wondered what a "pant" is. "Deac" writes that they are one and the same—*". . . a pair of pants is always a 'pant' in the trade. In fact, L. L. Bean, the famous Maine outfitter, still advertises 'Bean's Hunting Pant.'"* In other words, you can drop the "ess" without risking arrest for indecent exposure.

Wool-Clipper

• • • To save precious time, Winston Churchill asks British government officials to leave the verbal embroidery out of their reports. He says:

> "Let us have an end of such phrases as, **'It is of importance to bear in mind the following consideration . . .'** or **'Consideration should be given to the possibility of carrying into effect . . .'** Most of these woolly phrases are mere padding, which can be left out altogether or replaced by a single word. Let us not shrink from using the short expressive phrase, even if it is conversational."

Sound advice, and even sounder if the fifth word from the end is changed to "especially."

Monotonous But Nice

• • • An advertising agency man writes:

> **"Why does your industry eternally and monotonously answer questionnaires by saying your meal ticket is their favorite paper. The uniformity of effect suggests some sort of Gestapo influence. Have you got something on the industry?"**

Nope. It's just love.

Pardon Me While I Button This

• • • Right after reading a letter from a kindly Canadian stating that he gets an occasional "belly laff" from this page, we read this news item sent in by Don James, your favorite family journal's Cleveland eyes and ears:

> **Stainless steel wire can be left indefinitely in the abdominal wall after incisions are sewn, and the wire will give permanent strength to weakened muscles, was reported at a medical society convention here recently.**

The juxtaposition of belly laffs and wire-stitched midriffs is painful. We hope that the surgical seamstresses will be thoughtful enough to prescribe a strict diet of obituaries to begin with, and taper off with say the less exciting portions of the *World Almanac.*

Breath-Taker

• • • This is written while we are at the National Metal Show, the greatest, grandest and most glittering of all time, and we feel that in justice to our 18 loyal readers, who depend on this page for the facts of life, we should say something about it. However, we have merely seen it and have not yet digested it. So we will duck the assignment for the time being and leave it in the hands of the brains department, which was at the Show in full battle strength, and whose findings are reported elsewhere in this issue.

We feel, however, that we should report that the elevators in the Hotel Statler, where the A.S.M. technical sessions were held, are operated by blondes in the daytime and brunettes at night.

Puzzle

• • • So far we have steered clear of tricky problems. The following may not be tricky but we have a suspicion that it is, so we will give the answer, too. The problem is:

> *A man who weighs 190 lb. wishes to take three packages, each weighing 5 lb., across a small bridge which will support only 203 lb. How does he do it?*

The answer is that he juggles the packages. Whether or not this will work, we do not know. Even though the man is a proficient juggler and can keep two of the packages in the air, it may be that the shock of catching the packages will cause the bridge's capacity to be exceeded.

We doubt that this can be solved merely by dropping a 5 lb. package on a scale and observing the weight of the impact, for the juggler could break the fall of the package the same way a boxer rolls with the punch. If any of our readers who weigh 190 lb. will stand on a scale, juggle three 5 lb. weights, and let us know what happens, we shall be grateful.

DO YOU HAVE SUFFICIENT TEMPERING CAPACITY?

Is production being slowed down in your plant due to inadequate tempering furnace equipment? If so, now is the time for the Cyclone Tempering Furnace to move in and blast the jams out of your production line, as it is doing for thousands of other heat treaters.

. . .

You see, the Cyclone didn't become industry's favorite tempering furnace by accident. Just a squint into the work chamber of the Cyclone will convince you that chance had nothing to do with it, for the Cyclone was *designed* to be the husky brute that it is, and has *proven* that it can stand up under all the abuse that anybody could give it without wincing or faltering for a single instant. And, in addition to its ability to stand up on the production line and handle the heaviest loads you can pile into it day after day, 24 hours a day, the Cyclone gives you *laboratory heating accuracy.* So whether or not you are faced with the toughest government or private specifications being written today, you can relax the frown the day the Cyclone moves into your plant, for the Cyclone takes those plus or minus 1-point Rockwell "C" specifications without batting an eye.

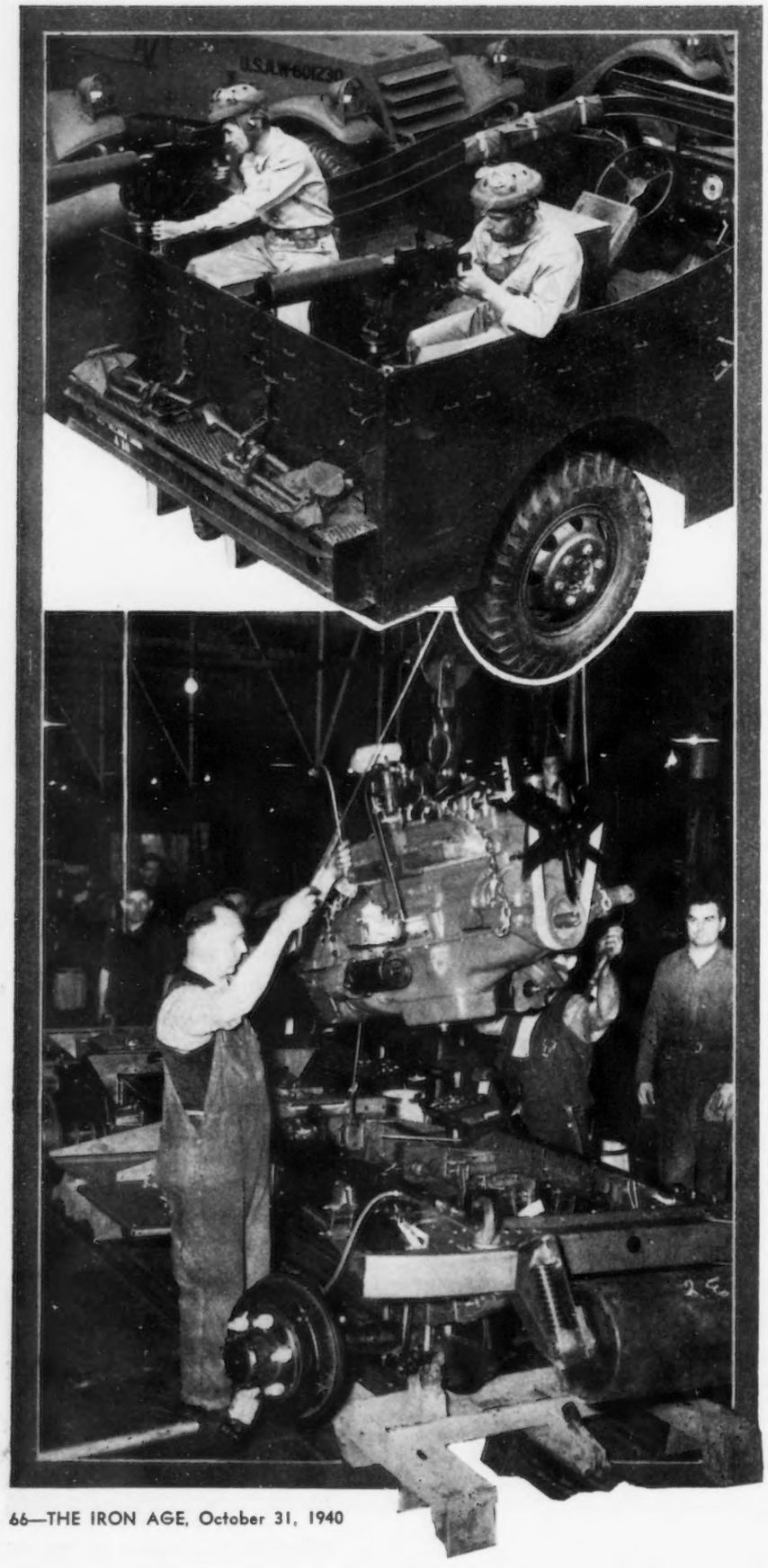
Put the Cyclone to work and watch those production jams disappear. Catalogue on request, or contact the nearest district office.

LINDBERG ENGINEERING COMPANY
228 North Laflin Street Chicago

LINDBERG FURNACES

HYDRYZING FOR HARDENING • CYCLONE FOR TEMPERING

News of Industry . . .



3 States Given Third Of Defense Contracts

New York

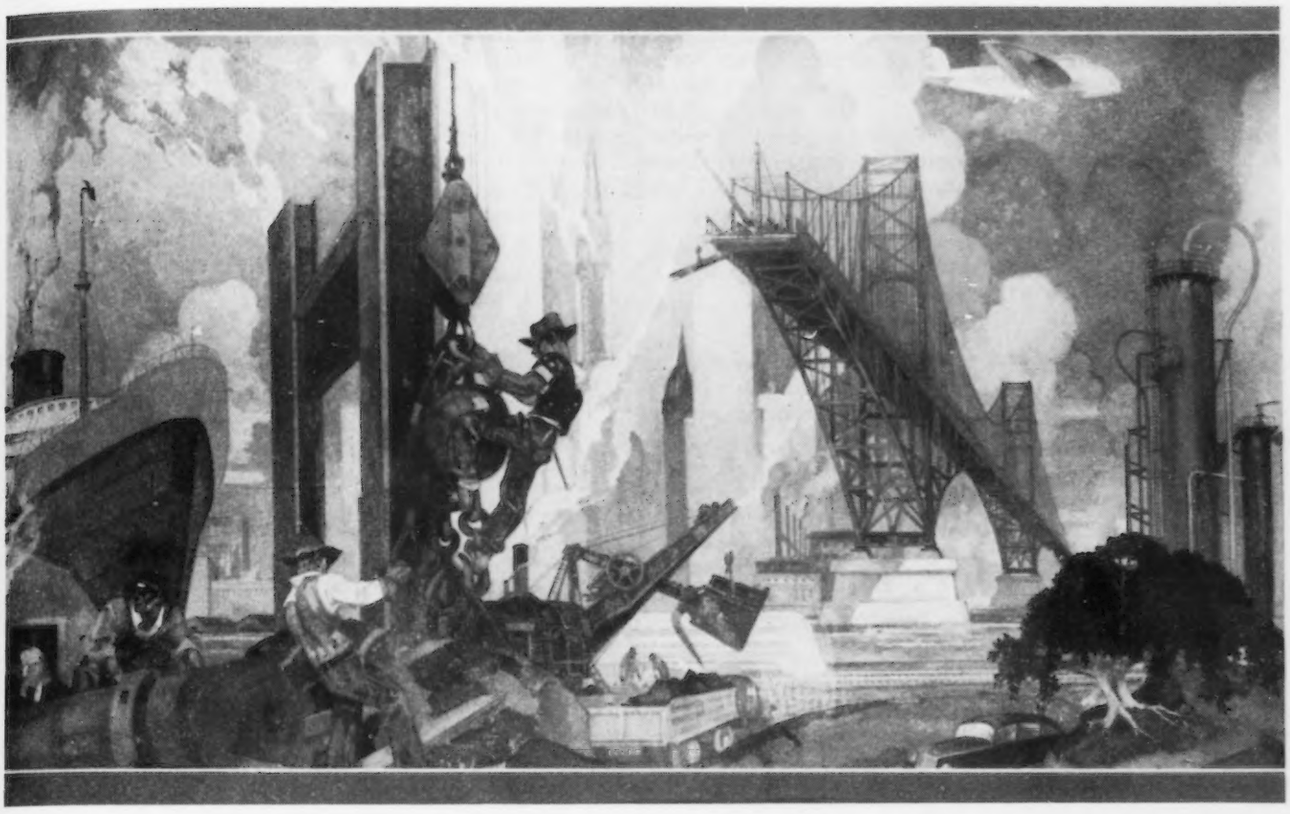
• • • **With total Army** and Navy contracts actually awarded in September more than double in value those let from June 13 to Sept. 1, the Middle Atlantic region, comprising New York, New Jersey and Pennsylvania, increased its already heavy lead over other areas, according to a study just completed by the Division of Industrial Economics of The Conference Board. Its share amounted to about one-third of the value of all contracts let.

The New England and South Atlantic regions continued in second and third places respectively, but their percentages fell in relation to the worth of all orders placed.

The cumulative total of awards since the beginning of the defense program in June rose during September from $2,244,000,000 to $7,921,000,000, as orders for new ships accounted for $5,017,000,000, or for 63.3 per cent, of the new total. This latter compares with 51 per cent on Sept. 1 and indicates the continued and increased importance of these contracts over all other kinds. Airplane orders, totaling $167,000,000 on Sept. 1, also increased in relative importance, rising from 7.5 per cent to 11.6 per cent during the month to reach a new total of $922 million.

The other two categories, construction and supplies and ordnance, increased in the absolute value of contracts let, but their percentages of total orders fell.

SCOUT CARS for the Army—Shown at the top is a fully-equipped scout car rolling off the assembly lines of the White Motor Co.'s Cleveland plant. The White company is building 50 of these cars a week and has contracts for 2414. Left, below, mechanics are lowering the engine into the chassis of a scout car. The cars are armed with three machine guns each.



ON OCT. 26 the Chicago Museum of Science and Industry opened to the public a new and enlarged iron and steel exhibit area. A feature of this display is the large murals in the museum's main entrance hall. One of these murals, which were presented by Inland Steel Co., is shown above.

Booklet Lists Titles On Defense Subjects

Detroit

• • • **A booklet** "Industrial Training for National Defense" by Charles M. Mohrhardt, chief of the technology department of the Detroit Public Library, has been published by the American Library Association. The booklet is essentially a selected list of up-to-date titles of books and publications that should prove useful in the defense training program of industry. Each publication that is mentioned has a symbol indicating its particular interest for vocational students, apprentices and beginners; machinists, skilled workmen, factory superintendents and foremen; student engineers and designers, and engineers and designers. About 8000 copies of the list were originally distributed by the American Library Association. It is now in its second printing and almost 20,000 copies have been sold.

Allegheny Ludlum Net $1,300,582 for Quarter

Pittsburgh

• • • **Allegheny Ludlum** Steel Corp. reports consolidated net profit of $1,300,582 for the quarter ended Sept. 30 after depreciation, depletion and federal income taxes, equal after dividend requirements on 7 per cent preferred stock to 99c. a share. This compares with profit of $327,772 or 21c. a share in the corresponding quarter of 1939 and $1,008,121 for the quarter ended June 30. Net profit for the nine months aggregated $3,193,873 as against $682,094 in 1939.

Coming Events

Oct. 31 to Nov. 2—Society of Automotive Engineers, national aircraft production meeting and exhibition, Los Angeles.

Dec. 2 to 7—National Exposition of Power and Mechanical Engineering, New York.

Henderson Finds Price Stability "Healthiest Sign"

New York

• • • **Leon Henderson,** price stabilization expert on the National Defense Advisory Commission, attributes the existing price level to an insistence by government on low industrial prices, its adoption by "business statesmen" plus a national policy of allowing ample agricultural supplies.

"My defense job is to watch prices," Mr. Henderson told the *Herald Tribune* forum last week. "Today the price level is lower than it ever was when wheels of industry were turning fast. This I regard as the healthiest sign of our industrial well-being."

The administration economist likewise painted a picture of complete harmony within the defense commission. "In all these months no decision has been other than unanimous," he said.

Bethlehem Installs 2nd Butt-Welding Mill

• • • **A second unit** has recently been added to the continuous butt-welding mill at the Maryland plant of Bethlehem Steel Co., Sparrows Point, Md. The unit, designed for production of pipe in sizes from 1 to 4 in. nominal diameter, in standard and extra heavy weights, rolls skelp from 6 to 16 in. wide, up to 0.380 in. thick. Based on 4 in. pipe the maximum rated capacity is 25 tons of skelp an hour. The skelp is supplied in coils from 30 in. to 44 in. diameter, weighing approximately 900 to 2500 lb. each.

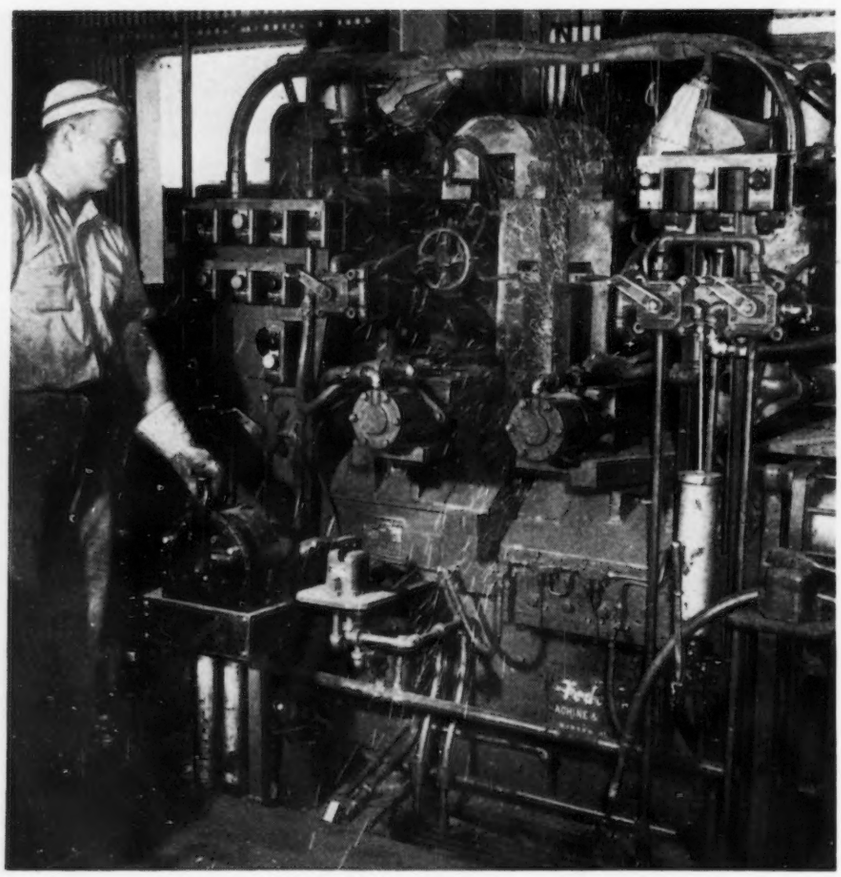
The first butt-welding unit was described in the June 13 issue of THE IRON AGE. The skelp is uncoiled and fed to an electric flash welder. It then passes over a double looping bed, with a 150 ft. primary and a 35 ft. secondary loop, to a 157 ft. long heating furnace which has a heating chamber 2 ft. 7 in. wide at the top and 22½ in. wide at the bottom. The furnace is equipped with 334 nozzle-mixing burners spaced at 9 in. centers the full length of the furnace, except for a 15 ft. preheating zone at the charging end. The burners are arranged in groups of 11, connected to a common header. Total burner capacity is about 140,000 cu. ft. of 500 B.t.u. mixed gas per hour, delivered at 4 to 8 oz. pressure.

The combustion air is preheated to 900 deg. F. in six silicon carbide tubular recuperators, two for each heating zone.

The heated skelp is drawn through a series of six roll passes, consisting of three pairs of horizontal and three pairs of vertical rolls. This is followed by a flying hot saw where the pipe is cut into predetermined lengths up to 50 ft. The cut lengths pass over a cooling rack and are conveyed to a descaling and sizing mill. After passing over a second cooling rack the pipe is ready for the regular finishing operations.

With the new unit in operation the mill is producing continuously butt-welded pipe in all standard sizes from ⅜ in. to 4 in. nominal diameter.

ELECTRIC FLASH welder, Unit No. 2, continuous butt welding mill at Bethlehem steel Co.'s Maryland plant at Sparrows Point, Md.



How Britain Allots Its Output of Steel

London

• • • **Introducing the** British Iron and Steel Control's simplified plan for distribution of steel, Col. J. J. Llewellyn, parliamentary secretary to the Ministry of Aircraft Production and chairman of the Raw Materials Priority Committee, refers to it as the only method of insuring that the best use is made in the national interest of available steel supplies.

The essence of the plan consists of obtaining from the government departments concerned authority to use a symbol distinguishing the exact purpose of a particular job. Having obtained this authority in respect of a given quantity of finished steel the contractor or consumer places his order with the steel mill or merchant in the ordinary way, quoting the departmental symbol contract or reference number and a period in which the delivery is required. The quantity of steel supplied against such orders is then debited against the quota of steel allotted to the authorizing department. In this way the total quantity of steel which can be produced, quarter by quarter, is distributed according to the degree of urgency in each case, while at the same time avoiding bottlenecks which would result from indiscriminate ordering in excess of available production.

305,134 U. S. Steel Corp. Shares Held in Holland

• • • **Common stock of the** United States Steel Corp. outstanding Sept. 30, 1940, amounted to 8,703,252 shares while preferred stock totaled 3,602,811 shares.

Foreign holdings of Steel common Sept. 30, 1940, amounted to 505,038 shares or 5.80 per cent of the issue, compared with 503,195 shares, or 5.78 per cent, held June 30, 1940. Of the preferred stock 75,982 shares, or 2.11 per cent, were owned abroad September 30, 1940, against 72,614 shares, or 2.01 per cent, so held June 30, 1940. Of foreign-owned common stock 305,134 shares were owned in Holland, 105,527 shares in Canada, and 46,112 shares in England.

1939 Pig Iron Output, Jobs, Wages Under '37

Washington

• • • **Preliminary figures** compiled by the Census Bureau show that manufacturers of pig iron and ferro-alloys reported moderate decreases in employment, wages and production for 1939 as compared with 1937.

The number of establishments decreased from 87 to 81; value of products decreased 18 per cent to $550,802,313; number of wage earners decreased 15.3 per cent to 19,537; and their wages declined 25.5 per cent to $28,312,336.

As defined for census purposes, the blast furnace products industry embraces establishments engaged in the manufacture, from ore and scrap, of pig iron, ferro-alloys—spiegeleisen, ferro-manganese, ferro-phosphorus, ferro-silicon, etc.—and castings made direct from the furnace. Even where blast furnaces are operated in conjunction with steel works, they are treated as separate establishments for census purposes.

Pig iron and ferro-alloys totaled 31,518,095 tons valued at $521,207,962 in 1939 as compared with 36,770,313 tons valued at $642,719,198 in 1937. Basic pig iron totaled 22,792,395 tons in 1939 and 25,112,653 in 1937; bessemer, 4,886,412 and 5,586,508 tons respectively; foundry, 1,680,194 and 2,761,212 tons, respectively.

Pig Iron and Ferro-Alloys Made in Blast Furnaces—Production, by Grade, Smelting Fuel, and Method of Delivery or Casting: 1939 and 1937

	1939	1937
Classified by Grade		
Total tons (2240 lbs.)	31,518,095	36,770,313
Basic	22,792,395	25,112,653
Bessemer	4,886,412	5,586,508
Foundry	1,680,194	2,761,212
Malleable	1,349,389	2,290,358
Low-phosphorous, forge or mill, and miscellaneous	248,552	353,496
Ferro-alloys made in blast furnaces	525,416	629,334
Direct castings made in blast furnaces	35,737	36,752
Classified by Smelting Fuel		
Total tons (2240 lbs.)	31,518,095	36,770,313
Coke:		
Total tons	31,474,062	36,688,815
For consumption in other plants of same company and affiliated companies	27,357,271	30,032,123
For sale[1]	4,116,791	6,656,692
Total value	$520,164,517	$640,904,093
Charcoal:		
Tons	44,033	81,498
Value	$1,043,445	$1,815,105
Classified by Method of Delivery or Casting		
Total tons (2240 lbs.)	31,518,095	36,770,313
Delivered molten to steel works, etc.	25,123,491	26,124,338
Machine-cast	6,030,320	10,119,160
Chill-cast	199,716	306,756
Sand-cast	128,831	183,307
Direct castings made in blast furnaces	35,737	36,752

[1] Figures include data for a small tonnage produced by a combination of coke and coal.

1939 Hand Tool Output 5.9% Under 1937 Total

Washington

• • • **Production** of insulated wire and cable in 1939 was valued at $120,390,050, a decrease of 10.6 per cent as compared with the $134,633,318 reported for 1937, according to the Bureau of the Census.

A drop of 5.9 per cent was reflected in the output of hand tools, whose 1939 value was $75,290,333 against $80,045,549 in 1937. The industry as constituted for census purposes does not include edge tools, machine tools, files and saws.

The value of wiring devices and supplies produced last year was $94,305,273, a decline of 1.1 per cent under the 1937 value of $95,390,598.

Ship Building Repair Concern's Total 406

Washington

• • • **Preliminary** census figures show that shipbuilding and ship repairing establishments reported a considerable increase in value of work turned out and moderate increases in employment and wages for 1939 as compared with 1937.

Number of establishments increased 15 per cent to total 406 in 1939; value of products increased 37.3 per cent to $327,387,099; number of wage earners increased 12 per cent to 66,611 and their wages increased 15.4 per cent to $104,473,303.

1939 Tin Terne Plate Output Under 1937

Washington

• • • **Declining** 5.6 per cent, the production of tin plate and terne plate in 1939 amounted to 5,711,326,129 lb., compared with 6,049,851,997 lb., in 1937, according to a preliminary report of the Bureau of the Census. The 1939 value was $259,661,768, a drop of 7.1 per cent under the 1937 value of $279,637,946. Details follow:

	1939	1937	Per Cent of Increase or Decrease (—)
Number of Establishments	34	34	(*)
PRODUCTS			
Total value	$264,444,538	$285,775,176	— 7.5
Tin plate and terneplate:			
Total pounds	5,711,326,129	6,049,851,997	— 5.6
Total value	$259,661,769	$279,637,946	— 7.1
Tin plate:			
Total pounds	5,121,442,997	5,433,508,753	— 5.7
Total value	$235,946,198	$254,289,064	— 7.2
Coke plate—			
Pounds	5,083,675,697	5,382,573,615	— 5.6
Value	$233,703,036	$251,520,497	— 7.1
Charcoal plate—			
Pounds	37,767,300	50,935,138	—25.9
Value	$2,243,162	$2,768,567	—19.0
Terneplate, including long terne:			
Pounds	589,883,132	616,343,244	— 4.3
Value	$23,715,571	$25,348,882	— 6.4
Other products, including tin dross, scruff, scrap, etc., value	$4,782,769	$6,137,230	—22.1

*Per cent not computed where base is less than 100.

Treasury Clarifies Amortization Law

Washington

• • • **Advising manufacturers** what they must do in order to be allowed to charge off the value of new defense plant facilities in five years for tax purposes, the Treasury Department late last week laid down the rules to be followed under the amortization provisions of the excise profits tax law.

The rules were represented as giving a broad interpretation to the law so that a holder of defense contracts may switch from normal to rapid depreciation and even back again to normal if he so elects. Treasury experts emphasized that once a contractor receives the amortization privilege on a piece of defense construction he cannot lose it.

The Second Revenue Act of 1940 extends to defense contractors the privilege of depreciating the cost of plants in five years rather than the customary 15 or 20 years, provided the facilities are of emergency defense nature. Under the Treasury ruling just made, construction taking place after June 10, 1940, can qualify for the speedy amortization but not construction undertaken prior to that date. It was explained that the five-year amortization plan could not be permitted even on a portion of a building erected before June 10 despite the fact the entire structure, completed after June 10, is used for carrying out defense orders.

The law provides that before taxpayers are eligible for the amortization privilege they must be certified as to the necessity for new plant expansion by the National Defense Advisory Commission and either the War or Navy Departments. Contractors may elect to follow either the new five-year plan of depreciating new construction or to continue with the customary slower normal charge-off allowances.

Treasury tax experts concede that some firms may not choose to use the rapid amortization privilege, being fearful that the termination of the five-year period may find the national emergency still in force, their profits high, and yet no longer permitted to make tax deductions for depreciation.

YOUNG MECHANICS at Randolph Field, Texas, are shown checking some of the planes in the nation's rapidly-expanding air forces.

Photo by International

Senate Group Will Investigate Prices

Washington

• • • **The National** Defense Advisory Commission and the Department of Justice are expected to cooperate with a Senate interstate commerce sub-committee in a Congressional inquiry of prices and "bottlenecks" that might hamper the defense program.

Chairman Wheeler, anti-New Deal Democrat of Montana, disclosed that the work of his subcommittee will be broad enough to go into any phase of the defense program but that particular attention will be given to reports that "extortionate prices have been charged to the government in some instances." Senator Wheeler specifically mentioned lumber prices as a likely subject, warned against a recurrence of World War "charges" and "countercharges" from which he said some people built up great fortunes, but emphasized that the investigation will be no "witch hunt."

Originally, the committee was directed by the Senate to scrutinize reports that certain domestic and foreign concerns were linked by ties that might be detrimental to the defense program. The resolution was later amended to permit a broader inquiry.

AFL Union Defeated At Buffalo Pipe Plant

Washington

• • • **The National** Labor Relations Board has certified The Independent Sanitary Iron Moulders Union as sole collective bargaining agency selected by a majority of the production and maintenance employees of Buffalo Pipe & Foundry Corp., Tonawanda, N. Y. The election, held Sept. 18, resulted in a count of 33 to 30 in favor of the Independent, with two challenged ballots. The board held that since the counting of the two challenged ballots could not affect the results of the election it was unnecessary to make any determination with respect thereto. Pursuant to a request by AFL's International Moulders Union, the board omitted the IMU from the ballot.

Nelson Heads Small Business on Defense

Washington

• • • **Donald M. Nelson,** coordinator of national defense purchases, has been designated director of small business activities in conformity with the policy of the National Defense Advisory Commission that smaller business occupies a vital place in the program.

Mr. Nelson's office will serve as a clearing house on War and Navy Department requirements and will help to facilitate financing of small business by cooperating with local commercial banks, the Federal Reserve Banks, and the Reconstruction Finance Corp.

The defense commission believes that Mr. Nelson will be in a position to effectively act as liaison between War and Navy procurement officers, potential contractors, sub-contractors and local bankers so that defense contracts may be executed simultaneously with provision for adequate bank or RFC financing.

On the assumption that the system of sub-contracting will be widely extended under the defense program, it is planned to decentralize the work of Mr. Nelson's division by designating a senior officer in each Federal Reserve Bank and branch to handle all problems relating to field and technical activities. In this connection the Board of Governors of the Federal Reserve System will act as operating agent for the defense commission.

Allis-Chalmers Offers Bonus to Drafted Workers

Milwaukee

• • • **Allis-Chalmers Mfg.** Co. is offering a bonus as part compensation to employees called into military service to consist of one month's salary as a bonus for salaried men or one-third of an employee's highest quarterly wages. Vacations not yet taken will be paid for and the company agrees to maintain group insurance policies. The proposed war salary adjustment had met with opposition from the CIO union officials who are seeking a year's pay and full seniority protection.

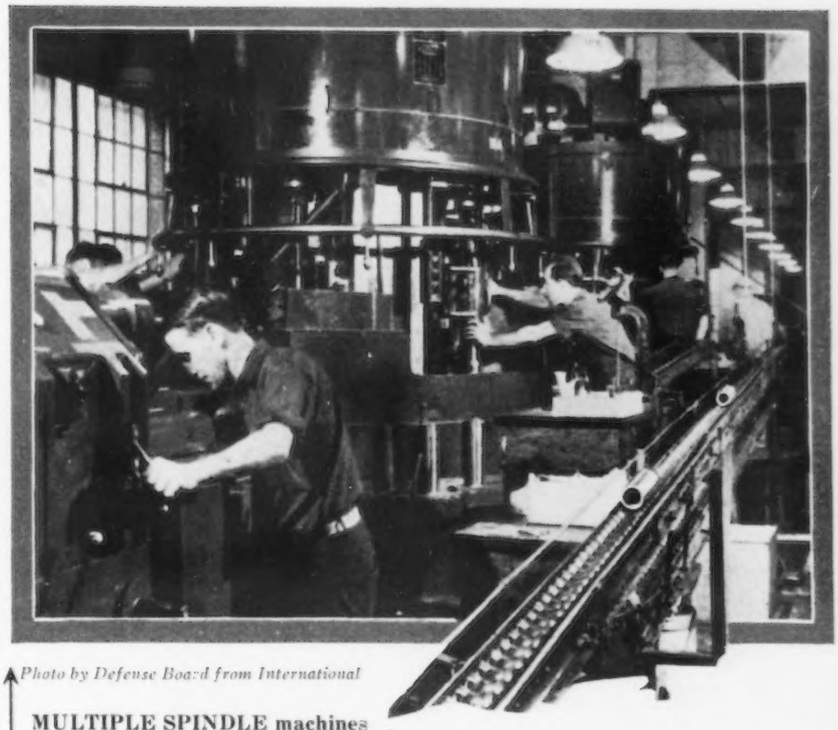


Photo by Defense Board from International

MULTIPLE SPINDLE machines at the Frankford arsenal, Philadelphia, are shown machining both ends of 75 mm. shells. Note the carrier belt at the right.

Baldwin Locomotive Orders Gain Sharply

• • • **Dollar value of** orders taken in September by the Baldwin Locomotive Works and subsidiary companies, including the Midvale Co. is announced as $20,170,756, compared with $8,182,650 for September, 1939. The month's bookings brought the total for the consolidated group for the nine months of 1940 to $67,194,224 as compared with $46,532,058 in the same period of 1939.

U. S. Awards $11,857,000 Toluol Plant Contract

Washington

• • • **The War Department** has awarded an $11,857,000 contract to the Humble Oil & Refining Co., of Houston, Texas, for facilities to manufacture toluol, essential material for making TNT. Details of the construction agreement follow the recently approved emergency plant facility contract.

Steel for War, Then Export, Britain's Plan

London

• • • **Apart from** isolated exceptions, capacity working remains the rule throughout the British iron and steel trades, and makers continue to be pressed for deliveries of all classes of product. The bulk of these is, of course, for war purposes, and it is noteworthy that civil demand has fallen off heavily. This, however, is principally due to the virtual impossibility of securing supplies.

Deliveries of material for war purposes which rank high in the priority list will absorb production for many months to come, and according to official policy any surplus thereafter will, where suitable, be allocated for the export trade. Potentially the export trade amounts to a substantial aggregate, but only minimum tonnages of material can meantime be released.

The shipyards and makers of sheets and tubes are large consumers of steel, while re-rollers and bar iron manufacturers, though handicapped by a shortage of raw material, are producing on a large scale.

Steel Prices May Go Up in Canada

Toronto

• • • **Canada's war** industry has brought forth many problems to the steel industry and requests are being received continuously for steel products not heretofore produced in the Dominion.

On ordinary classifications of iron and steel and their products demand is at the highest level in history, while the price situation is decidedly uncertain. As a result of the latter condition steel producers are refusing to quote definite prices on forward delivery contracts. Despite the fact that every effort is being made to maintain prices at current levels, situations now are developing which may have direct bearing on prices in the not distant future and some now predict advances for the beginning of the year.

Future delivery booking continues at a high level and on many materials orders have been closed for delivery well into first quarter, this booking giving assurance of delivery rather than price protection. New demand for sheets is specially heavy, with mills reporting orders for delivery into the first part of second quarter, 1941. In addition to the big flow of new orders for both black and galvanized sheets, additional heavy tonnages are overhanging the market and still other large buying will be necessary to fill new demands as government war contracts are placed, estimated to run about $116,000,000 monthly for the next six months at least. The automotive industry is the principal buyer of sheets, although electric equipment makers have been prominent in the market recently and other consumers also have been placing large orders. Canadian production of plates has been fully booked and imports are supplying a large part of current needs for tank and ship construction. The Hamilton plate mill, which will be completed and in production next February, however, will take care of a large part of domestic demand for 1941.

Expansion of Canada's war industry is proceeding rapidly. Announcement is made that a 2505-acre site has been expropriated just outside Toronto and construction work will be started without delay on a munitions plant to cost $10,000,000.

An announcement issued jointly by C. D. Howe, Minister of Munitions and Supply, and J. S. McDiarmid, Minister of Mines, National Resources and Industry, for the Manitoba Government, is that a contract has been let to Fraser Brace Engineering Co., Ltd., for immediate construction of a chemical plant near Winnipeg, estimated to cost about $10,000,000.

The Canadian government, through the Department of Munitions and Supply, also is assisting established industrial companies in financing plant expansion necessary to more extensive war production. Capital expenditures announced by C. D. Howe in the past week include $1,348,489 for Ford Motor Co. of Canada, Ltd., Windsor, Ont., and $398,000 for Hayes Steel Products, Ltd., Merritton, Ont.

British Move U. S. Plane Headquarters

Washington

• • • Headquarters of the British Ministry of Aircraft Production will be moved from New York to Washington in order to maintain a closer collaboration by British aircraft engineers and representatives of the United States Government. To occupy the entire structure at 1785 Massachusetts Avenue, the offices of the air ministry is expected to perform purely technical functions and to be divorced from purchasing activities handled by the British Purchasing Commission located in the Willard Hotel.

Ammunition Factory Is Planned for Kansas

Washington

• • • **The War Department** has announced that a small arms ammunition plant will be constructed in the vicinity of Kansas City. The plant will be civilian constructed and civilan operated, on a cost-plus-fixed-fee basis.

Electric Industrial Trucks at '40 Peak

Chicago

September unit bookings of electric industrial trucks and tractors, at 154, reached the peak for the year to date, the Industrial Truck Statistical Association, 208 South LaSalle Street, Chicago, reports. The previous high was 151 in July.

Total net value at factories for chassis only was $550,206, compared with the July total of $591,784.

Eleven non-elevating platform trucks with capacities and chassis base prices ranging from 2000 to 6000 lb. and $1,575 to $1,875, respectively, had a total net value at factories of $21,070. The net values given are after additions and deductions for variations from standard specifications, trade-in allowances, etc., if applicable; 129 cantilever type trucks, capacities and chassis base prices ranging from 1200 to 20,000 lb. and $2,000 to $11,905, respectively, had a total net value at factories of $481,751; eight tractors ranging in capacity and base chassis prices from 475 to 2000 lb., draw bar pull, and $1,570 to $1,625, respectively, had a total net value at factories of $13,050; five cranes ranging in capacity and base chassis prices from 1000 lb. at 5½ ft. radius to 10,000 lb. at 5½ ft. radius, and $4,780 to $7,450, respectively, had a total net value at factories of $30,585; one special rack handling truck of 2000 lb. capacity had a base chassis and total net price at factory of $3,750.

Toledo Employment Highest in 3 Years

Toledo

• • • **A combination** of automotive and textile activity, plus defense work, has boosted employment in Toledo industries to a three-year peak. From 51 plants there are reports of 22,038 workers on payrolls, a net gain of 836 in a week. Employment is about 18 per cent above last year. Total number of workers is estimated at more than 70,000.

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No Plan to Commandeer Equipment, Machine Tool Dealers Are Told

• • • **Voluntary cooperation** on the part of the machine tool industry has been given freely in connection with the problem of tooling for defense needs so that at present there is no government plan to commandeer any machine tools, except certain machines at dock for which no export licenses are available, it was brought out by several speakers at the annual convention of the Associated Machine Tool Dealers of America, held at Dayton, Ohio, Oct. 21 and 22. Albert M. Stedfast, of Stedfast & Roulston, Inc., Boston, indicated that a rider in the Draft Act made applicable right now section 120 of the National Defense Act of June, 1917, which gave the President power to take over plants that refused to cooperate in building defense material for which they were fitted, but that in many other ways pressure could be brought to bear without resorting to this provision.

On the other hand, Mr. Stedfast pointed out that Bill S4621 gives the President authority to commandeer machines held up for export. There are now several thousand such machines in New York warehouses. It has been difficult to identify such boxed equipment, but a complete listing is now in the hands of the National Defense Advisory Commission. These tools will be available to defense contractors at the original purchase price plus costs.

A. B. Einig, machine tool division, National Defense Advisory Commission, touching on the matter of exports, pointed out that the RFC had set aside a $10,000,000 revolving fund to take care of the interim financing of machine tools held up at dock until a domestic purchaser could be obtained. Speaking of the present machinery for licensing machine tool exports he indicated that considerations of international policy were generally involved and hence rulings varied with conditions in the international situation.

Mr. Einig forecast an annual machine tool demand of $600,000,000 or higher for the next two years. Deliveries even to defense industries are running into the middle of 1941 and some critical items are deferred into the early part of 1942. Expansion programs now under way are expected to alleviate this particular condition by the middle of 1941, however. Gages are in great demand and the normal annual production of $4,000,000 worth of gages will have to be quadrupled for the next two years. There is also tremendous demand for large forging equipment and other heavy machinery for fabricating armor plate. In concluding he praised the wholehearted support of the machine tool industry and characterized it as having met the challenge in defending the American way of life.

Tell Berna, general manager of the National Tool Builders Association, referring to voluntary priorities under the preference classification system, said that the fact that the bulk of present defense contracts were rated A-1 had created an indigestible demand for machine tools. The most important factor involved in such cases is not the classification number but the shipping date for the finished goods. It will probably be necessary, he thought to further subdivide reference classifications into A1A, A1B, etc. (Ed. Note: This is being done.) At the same time, Mr. Berna cautioned buyers with old orders on the books of machine tool builders to get official preferential ratings on their projects in order to avoid shuffling of shipments in favor of newer orders with A1 ratings.

Another speaker at the same session was D. H. McKellar of the Monarch Machine Tool Co. who explained the evening study courses being offered to Monarch employees. Over one-third of the working force is taking such courses which are given in outside time four nights a week. The following

HILLSIDE FLUORSPAR
85% AND OVER IN CALCIUM FLUORIDE
DOES NOT EXCEED 5% IN SILICA · FREE FROM SULPHIDES, LEAD AND ZINC
Steel Manufacturers
Standard Specifications
Shipments from stock
Rail or River
HILLSIDE FLUOR SPAR MINES
38 SOUTH DEARBORN STREET
CHICAGO, ILL.
MINES IN ILLINOIS AND KENTUCKY

896,000 Obtain Jobs During September

• • • Total unemployment in the U. S. dropped from 7,698,000 in August to 6,829,000 in September, a decrease of 869,000, or 11 per cent, according to the preliminary estimate prepared by the Division of Industrial Economics of the Conference Board. The sharp decline in September brought the total number of jobless to the lowest level since October, 1937, and marked a drop of 1,363,000 since September, 1939. The September total, however, remained 1,763,000 higher than the 1937 low. Total employment in September mounted to 48,404,000, the highest level reached since October, 1929, when employed workers numbered 49,033,000.

day, the entire group of machine tool dealers visited the Monarch plant at Sidney, Ohio.

Col. H. A. Toulmin, Jr., author of a series of recent articles in THE IRON AGE, spoke at the annual dinner on the topic, "Organizing for War." John Sauer, Jr., Peninsular Machinery Co., Detroit, and president of the association, presided. (An address made by A. G. Bryant, Bryant Machinery & Engineering Co., was abstracted in last week's issue on p. 66.)

New officers of the association elected were: President, F. B. Scott, Jr., Syracuse Supply Co., Syracuse, N. Y.; vice-president, Albert M. Stedfast, and secretary-treasurer, F. W. Schiefer, F. W. Schiefer Machinery Co., Rochester. New members of the executive committee are: Edward A. Lynch, Edward A. Lynch Machinery Co., Philadelphia; T. C. Stephens, Robert R. Stephens Machinery Co., St. Louis, and A. G. Wigglesworth, Wigglesworth Machinery Co., Cambridge, Mass.

Commercial Aircraft Priority Group Set Up

Washington

• • • **The National** Defense Advisory Commission has established a commercial aircraft priority committee to coordinate production and maintenance of air transport equipment with the requirements of the national defense program.

Publisher Heads Defense Board Aircraft Division

Washington

Merrill C. Meigs, publisher of the Chicago *Herald* and *American* and well known in aviation circles, has been named to head the aircraft division of the National Defense Advisory Commission.

Mr. Meigs, who succeeds Dr. George J. Mead, was named by Defense Commissioner William S. Knudsen, chief of the commission's production division. Dr. Mead resigned to devote all his time to research as a member of the National Advisory Committee for Aeronautics, of which he is vice-chairman. Dr. Mead, former United Aircraft executive, also is chairman of the committee's division of power plant research.

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• • •

NO more rejections . . . no more costly guesswork . . . because the Profilometer is on the job! When a roll blasted with abrasive grit or shot—such as that illustrated—is used to prepare the surface of sheet steel for the bonding of lacquers or enamels, there is a definite need for accurate measurement of surface roughness. If the roll is used too long, the sheet will not be of the required roughness and will be subject to rejection. If, in "playing safe," the roll is replaced too soon, the additional changeover time and the extra blasting operations on the roll obviously represent needless production expenditures.

The Profilometer assures absolute control of the surface roughness of both the roll and the sheet. Direct dial readings, giving measurements in true inch units, are made ***on the job*** as the work progresses. It provides the means to keep production costs to a minimum.

Wherever accurate control of surface roughness is a requirement, the Profilometer is exceptionally practical. It can be used on flat, cylindrical, external-curved, and internal-curved surfaces of wide variety, and of many sizes and shapes. It is designed, built, ***and used*** as a shop instrument. Literature describing and illustrating a number of its applications will be sent you immediately upon request.

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Mechanized War Puts Machine Tool Industry on Front Line

By JOHN E. LOVELY

THIS ADDRESS, here abstracted, was presented before the 39th annual meeting of the National Machine Tool Builders Association by Mr. Lovely, president of the association, and vice-president of Jones & Lamson Machine Co., Springfield, Vt.

• • • **The size and scope** of the national defense program is now unfolding rapidly. The program itself is beginning to take definite shape. Congress has now passed most of the legislation to start different parts of the program on its way. It has also passed the necessary appropriations to enable the government to let a large portion of the contracts for the huge task of armament. We do not know definitely how big the task ahead may be, but we are beginning to learn the size of the task embodied in the appropriation bills which have already passed. We know that the machine tool industry is only one of the countless industries that must and will perform their part in this defense program.

Each major war in the world's history has been fought in a different manner than its predecessor due to the difference in the type of equipment used, or the tactics employed. The present war in Europe is no exception. This war is being fought more with mechanized equipment than with men.

As a result of these developments, our defense program calls for new designs of tanks, guns, cannon, planes and more advanced types of fighting ships of all kinds. In fact, even the lessons learned in the last few months of the war in Europe have resulted in radical departures in design in a great deal of the equipment for conducting a war on the present pattern.

Machine tools owe their importance to the fact that they have to be used for the production of all of this mechanical equipment used in modern warfare. In many cases existing machine tools and existing plants may be employed. Much of the armament needed, however, cannot be made on existing machine tools and requires in many cases entirely new plants filled with new machine tools.

Existing government arsenals in peace time are used merely for the development and building in small quantities of instruments of war. It has always been the policy of our government to rely on existing industrial plants outside the government arsenals and navy yards for the production of 90 per cent of this material in time of war. It takes time for these existing industrial plants to learn how to make this war material in an emergency, and it takes time for them to acquire the necessary machine tools they need to supplement existing equipment. Many of the operations on war material require machine tools of a different type than are used for peace time activities.

In carrying out a defense program that involves all of the equipment needed by a modern fighting force, many steps are necessary:

1. Research and experimental work to develop the most effective types of weapons. This work must be done a long time in advance.

2. The working out of adequate plans and the determining of how many of each type of machine gun, cannon, airplane, etc., should be required, how many men should be mobilized and trained, the determination of the sequence of each of these events, and the setting up of a timetable for the completion of each step.

3. Passage of the necessary legislation by Congress, authorizing the program and providing the necessary funds.

4. Negotiation of contracts with industrial plants for the production of each item involved.

5. Determination by each contractor of how he will make each individual piece covered by his contract. Determination by him of what existing machine tools he can use, and the determination of what new machine tools are needed.

6. The placing of orders by each contractor for the necessary new machine tools needed.

7. The production of these vital machine tools.

8. The installation by each contractor of the new machine tools he has ordered, employing and training the necessary employees to produce the new arms and ammunition, and finally the coordinating of all of the activities in each plant.

From these facts it is apparent that no one knows what machine tools will be required until the defense program has developed to a point where it is definitely known what types of machine guns, aircraft and tanks are actually to be ordered, what the designs will be and what the quantities of each type will be. Until the program reaches this stage where each individual contractor can place his orders for the exact machine tools he needs, the machine tool builder is unable to plan his part of the program. We are just reaching this stage in the defense program.

This illustrates how difficult it is for any machine tool builder to know in advance what demands will be placed on him. It also indicates how difficult it is for the Advisory Commission to the Council of National Defense, or for the Army and Navy Munitions Board which is cooperating with it, to determine how many machine tools of each type will be needed by all the contractors for the whole program.

Fortunately, our industry has already long since, to a large extent, anticipated the job to be done.

Several years ago, many of the members of our industry felt much concerned that our own government was paying no attention to the preparation for war on the part of the aggressor nations. We

were equally alarmed at the failure of the other great democracies to put their own defenses in order. Many officials of our army and navy tried to arouse our country to the danger of our position. At that time we appointed a committee of important men from our industry to cooperate with the officials of the army and navy and other branches of government in problems of national defense.

This committee urged the government to put its arsenals and navy yards in good condition and to replace obsolete equipment in order that they might better serve our country in case of need. We urged the government to appropriate several million dollars a year for this purpose, but Congress would only appropriate a mere fraction of the sum we knew was necessary.

We urged the letting of educational orders, so that industry in general by obtaining actual experience with the problems involved might turn more quickly to the production of defense equipment should an emergency arise. Though the progress made was disappointing because our government at that time was strangely uninterested in these problems, we secured a degree of cooperation with the army and navy officials that has been of tremendous importance in the last year. This committee assisted the government in the tooling of new weapons, notably the Garand rifle.

After considerable study of the matter a full year ago, this committee made arrangements with the Ordnance Department to design single-purpose shell machines which could be built outside the machine tool industry. These designs are now available to the Ordnance Department for the letting of contracts for such machines, so that they may be built outside our industry if this proves desirable.

Early this year when our Government's national defense program was under consideration our industry expanded the committee to its present size of 15 men. This committee has since that time been cooperating closely and effectively with the government in all problems affecting our industry in connection with the defense program.

Strange as it may seem, just as we are embarking on the defense program, our industry today is operating at a higher rate of output than ever before in its history. This present condition is due to a very large extent to a demand for machine tools from abroad. If this export business had not been available, our industry would be in a very poor position today to take care of the present extraordinary demands of our own defense program.

JOHN E. LOVELY
"WE DO NOT KNOW definitely how big the task ahead may be. . . ."

It takes time to increase the capacity of any industry and to make plant expansions, to install equipment and train the necessary personnel. Furthermore, no industry can expand without having jobs to work on. Fortunately for the country, our industry has been exceptionally busy expanding its output, adding to its facilities and training added numbers of men during the last two years.

Our industry produced $185,000,000 worth of machine tools in 1929. In 1932 demand dropped so severely that for the years 1932 and 1933 average annual shipments were only $22,500,000. In 1935 output rose to $85,000,000 and in 1937, due to the combination of foreign and domestic demand, output reached $220,000,000, even exceeding the 1929 figure. Output in 1938 fell to $120,000,000 and a large portion of this was foreign demand. In 1939, due to the steady increase in foreign demand, output rose to $200,000,000. In 1940 on account of the large orders received in 1939 from England and France, and due to the added requirements of our national defense program, our industry expanded rapidly and the year's shipments will reach an all time high of roughly $400,000,000. In August of 1940 we were producing at the rate of $450,000,000 a year, just double the rate of August, 1939. I believe production in 1941 will greatly surpass this figure.

When we realize that our government would only appropriate $4,500,000 for machine tools in 1934, we can see what a drop in the bucket that appropriation was for national defense.

In spite of our accomplishments to date, we nevertheless still have a mighty big job before us. As we increase the production of machine tools again next year, many serious problems will be encountered by many of our plants. The present output can and will be increased as it was this year by:

(a) Additional use of existing plants and facilities.

(b) Farming out work to more sub-contractors, and

(c) Further expansion of some of our plants and the addition of still more equipment.

In expanding our output in this past year, many of our machine tool builders in their anxiety to do their part have actually expanded their plants and purchased machine tools to increase their own capacity before they were sure that their purchases would be needed, before they knew what the rules of the game would be, before they knew what the rate of tax would be, and before they knew how they were going to pay for the added facilities they were acquiring.

We know our industry is overexpanded already for the normal peace time business of the country and that, therefore, the expansions which have been made to take care of the defense program and the further expansions that may become necessary, should qualify for certification under the terms of amortization in the new tax bill.

It is not only a fair thing, but

a vital thing to our country that our industry be maintained in a healthy condition, and in a condition where it may continue to give service to our country in periods of emergency. The rush of work prevents operation at maximum efficiency. The forced training of new men and the necessity of using newly trained men results in a loss of time and spoilage of work if not kept in proper bounds.

We do feel, therefore, that government must be sympathetic to business and that business must be treated in such a manner that it will survive this emergency rather than be sacrificed to the emergency.

In all of the work that has been done to date our industry has had splendid cooperation from all the officers of the army and navy, as well as from the Advisory Commission to the Council of National Defense. They have cooperated fully with our own defense committee in a constant study of the problems before us. The preference system as it applies to machine tools, whereby the Army and Navy Munitions Board is setting priorities on all of its requirements, is one result of this fine cooperation. This country is very fortunate because the officers of the army and navy in charge of plans and procurement are alert to the needs of the new methods of warfare, and have an excellent understanding of the problems of industry in fulfilling these needs.

As we review what progress has already been made, as we are able to further check the size of the program by definite orders as they are being placed, I feel confident that our industry can and will do its allotted task in a satisfactory manner.

Let us remember these facts. The industrial development in our country greatly exceeds that in any other nation of the world. The intensive development here of high production machine tools has been both the cause and the result of the tremendous industries in the United States. We are now actually hitting our stride in converting this huge industrial capacity to the production of material for defense. We know that we can and that we will build up the strongest defense in the world, and that we can and that we will give England the vital assistance she needs.

What the eventual size of our defense program will be, only coming world events will reveal. If it is limited to the program covered by legislation already passed, we are confident our industry will take it in its stride. If the present program is merely a starter, then I know you men certainly will find ways of taking care of the added problems as they materialize.

We want it definitely understood that insofar as the national defense program depends on the machine tool industry, we are resolved that we shall not be found lacking, and that as individuals, as companies or as an industry, we will find the means to furnish the machine tools that are needed.

F. V. Geier President of Machine Tool Builders

• • • **Frederick V. Geier,** president of the Cincinnati Milling Machine Co., Cincinnati, was elected president of the National Machine Tool Builders' Association at the annual meeting of the association held Oct. 24-25 at the Edgewater Beach Hotel, Chicago. He succeeds John E. Lovely, vice-president, Jones and Lamson Machine Co., Springfield, Vt. Other officers elected were: first vice-president, Clifford S. Stilwell, executive vice-president, Warner & Swasey Co., Cleveland; second vice-president, George H. Johnson, president, Gisholt Machine Co., Madison, Wis.; and treasurer, E. C. Bullard, vice-president, Bullard Co., Bridgeport.

FREDERICK V. GEIER, above, president of Cincinnati Milling Machine & Cincinnati Grinders, Inc., has been elected president of the National Machine Tool Builders Association.

Three new directors were elected for a three year term to serve on the board of nine. They are L. W. Scott Alter, president, American Tool Works Co., Cincinnati; David Ayr, president Hendey Machine Co., Torrington, Conn., and George H. Johnson. Mrs. Frida F. Selbert continues as secretary and Tell Berna as general manager of the association.

Except for the president's address given by Mr. Lovely and abstracted elsewhere in this issue, most of the proceedings of the meeting were "off the record." One such session led by Clayton R. Burt, chairman of the defense committee of the association, and participated in by Mason Britton, director, machine tool division, National Defense Advisory Commission, was devoted to various angles of the defense program as it related to machine tools. At a later open meeting, Col. A. B. Johnson, Army and Navy Munitions Board, spoke briefly of machine tool procurement problems. He complained that too many defense contractors are buying complete new machines and are not making sufficient use of existing facilities. He cautioned buyers against demanding deliveries on machine tools before they were actually needed. So many ordnance contracts have been given an A1 preference rating that six sub-classifications have been devised, running from A1-A to A1-F. He also revealed that the new legal machinery for commandeering machines held up for lack of export license was put into action for the first time last week, but that a standard procedure for handling the resale of this needed

equipment has yet to be worked out.

Mr. Berna in his report to the association added another word of caution to customers of the industry in specifying delivery dates. The chief problem, he said, is the establishment of an orderly estimate of the total requirements of machine tools for the defense program. If such an orderly procedure is adopted, placing the most urgent needs first, the machine tool industry can take care of the vast problem, but buyers will have to stop asking for machines "next Wednesday." He proposed that manufacturers work into new production gradually, working out the shop "bugs" as they go along and extending the delivery of machine tools over several months.

India Limits Iron Exports to Japan

Tokyo

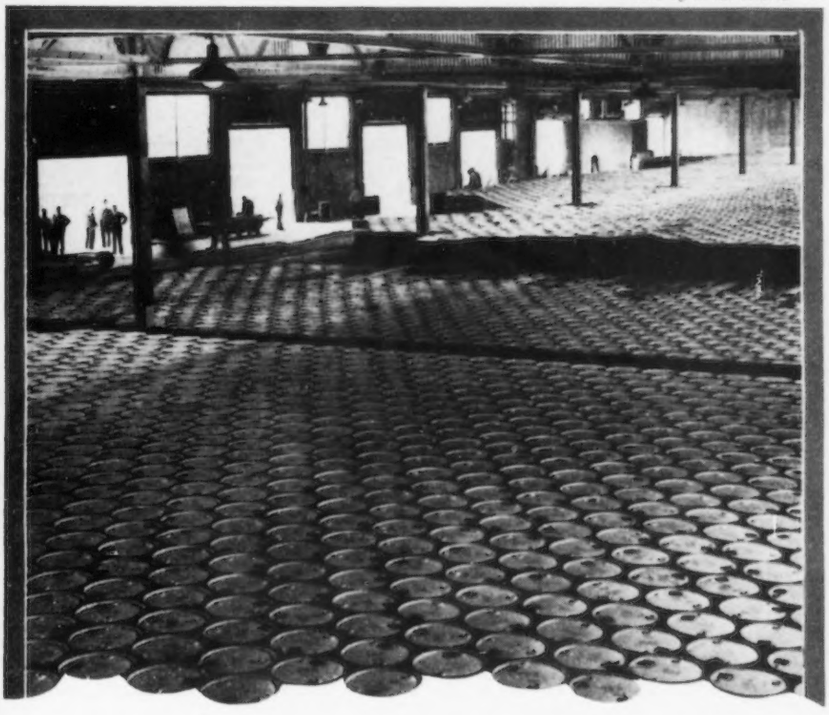
• • • **News has been** received in Tokyo that the government of British India has limited pig iron exports to Japan to a maximum of 10,000 tons a month.

The measure comes in the wake of similar restrictions in other parts of the British Empire, and in the United States. In the absence of Japanese output statistics, it is difficult to say what the effect of these embargoes has been on Japan's steel production.

In 1936, Japan imported 375,000 tons of pig iron from British India. Other important suppliers were the Soviet Union and Manchuria. Dependence on India pig iron has presumably increased as imports from Russia ceased. Total imports of ores and metals from British India amounted to 32 million yen in 1936 (including 15 million yen worth of pig iron, the balance being made up of iron ore, manganese, lead and some minor items), increased to 54 million yen in 1937, but slipped to 48 million yen in 1938. India's action follows the steel scrap embargo adopted by the United States.

GASOLINE FOR JAPAN—Longshoremen loading the Japanese vessel Onde Maru in Wilmington, Cal., recently struck because the American flag on the ship was not as high as the Japanese flag. The ship's captain finally raised the flags to equal heights. Some of the 25,000 drums of motor gasoline being loaded on the ship are pictured below.

Photo by Wide World



Sloan Sees Synthetic, Superficial Prosperity

• • • **Problems that have** beset industry for so many years still remain unsolved and are far too greatly unappreciated, Alfred P. Sloan said this week in a statement to General Motors Corp. stockholders.

"As far as the trend over the next two or three years is concerned, it seems assured," said Mr. Sloan, "that as long as the synthetic influence of the enormous amount of government spending continues, a high level of production will in all likelihood be maintained. Thus, we may expect the superficial indications of returned prosperity. And to the extent that this is true, to the same extent do we increase the price that ultimately we must pay, particularly if the expansion be accompanied by an abnormal increase in general prices."

Otis, Alan Wood Report Earnings Up

• • • **Otis Steel Co.,** Cleveland, reports net profit of $464,665 for the third quarter of 1940, after depreciation and deduction for Federal income tax, but before provision for the Federal excess profit tax. This compares with net loss of $196,629 for the second quarter and a loss of $184,517 for the third quarter of 1939.

Alan Wood Steel Co. reports net profit for the third quarter, after depreciation, taxes and interest, of $318,939, as compared with $224,313 in the preceding quarter.

American Rolling Mill Co.'s net earnings for the third quarter were $1,804,511, or 45.3c. a share, compared with $600,793, or 3c. a share, in the same period of 1939.

Superior Steel Corp. reports for the third quarter a net profit of $75,776 against $31,661 in the preceding quarter and $29,303 in the third quarter a year ago.

Interlake Iron Corp. earned a net profit in the third quarter of $269,096 compared with a net loss of $311,385 in the corresponding quarter last year and a loss of $147,190 in the second period of 1940.

Auto Industry to Set Up New Aviation Parts Organization

Detroit

A pool of the manpower and machinery of the automobile industry will be necessary to carry on the plan to manufacture airplane parts as outlined in Detroit last Friday in all-day sessions called by William S. Knudsen, production chief of the National Defense Advisory Commission.

Establishment by the industry of a new major organization to act as headquarters for the $500,000,000 aviation parts manufacturing program is indicated. Except that this organization will be wholly within the industry, it probably will develop into something closely resembling the defense commission itself—but it will also function as an operating unit for manufacturing purposes in addition to coordinating with the Army and aviation manufacturers. Growing out of the program fathered by the Automobile Manufacturers Association for subordination of automotive tooling plans in favor of aviation defense requirements, it probably will be closely linked to AMA in cooperation on the aircraft program.

Plans are being formulated, it is indicated here, for the virtual drafting of perhaps hundreds of key men to staff this new centralized setup. It seems likely that the industry has in mind some kind of pro rata draft of personnel, as well as machines. These, of course, will be industrial employees—**not government** workers—and will be concerned with administration, engineering, tooling, purchasing, etc. Briggs Mfg. Co. is already conducting a special school to train shop men for its initial contract to supply parts to Vought-Sikorsky.

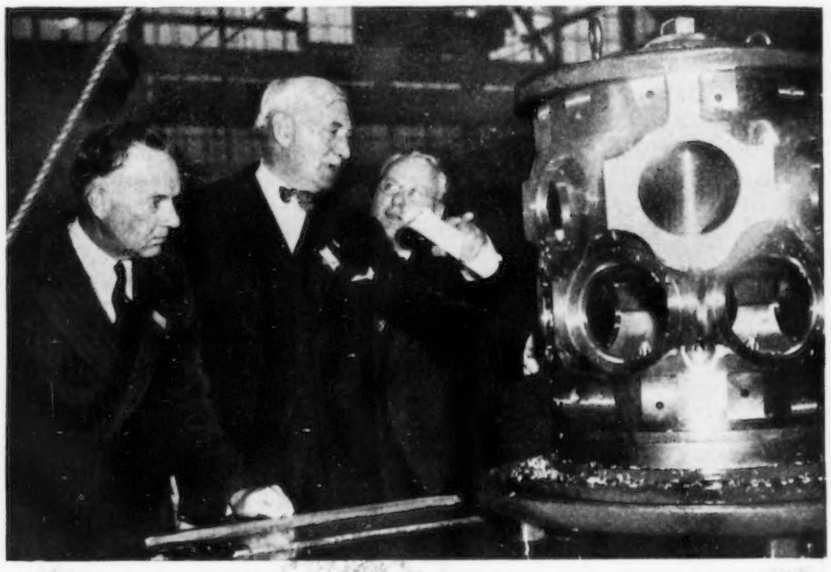
Nothing has been done yet about requirements of machines and materials; these, too, will be major problems to be settled as soon as the setup is ready to work.

No single project or group of projects undertaken in the defense program by the auto industry approaches this one in magnitude nor in significance for the industry. Size of the $500,000,000 parts program (in dollars, not startling in these days of billions) provides the first clue to the scope of the plans and the size of the organization required; the extended meetings of Knudsen with nearly a hundred key figures in the industry in AMA offices here provide further indication of what is in prospect. While the outcome, as reported in the press from announcements that were made here, was merely the appointment of a standing committee, actually Knudsen launched the organization of a giant new defense industry here, superimposing it on the auto industry.

In terms of production, the manufacture of $500,000,000 worth of airplane parts will be on a larger scale than has ever before been attempted. The undertaking involves the supply of some 400 different stampings and machined forgings for 12,000 of the two largest types of airplanes ever built. It is reported that the planes (to be assembled elsewhere) have not been ordered from plane manufacturers. In fact, previous commitments in the military aircraft procurement program have covered only 10,000 planes of all types, including trainers. When placed, it is reported, the orders will specify 8000 high-speed, twin-engined bombers from two companies (North American Aviation, Inc., Inglewood, Cal., and Glenn L. Martin Co., Baltimore, (both of which were represented at the AMA meeting here) and 4000 four-engined flying fortress bombers (from Consolidated Aircraft Corp., San Diego). These bombers will be of standardized designs and will cost nearly $2,000,000,000.

The $500,000,000 is approximately a quarter of the total sum involved, and this is ordinarily accepted as the proportion of airplane cost that goes for parts; the rest of the cost covers assembly and engines. Therefore, it appears that Detroit plants will be producing all of the required parts. Best yardstick of how much the $500,000,000 represents, is the knowledge that $500,000,000 exceeds slightly the total of all orders placed to date in this area for tanks, engines, guns, munitions, machines, tools, gages and all the other defense items ordered from Michigan industry so far this year.

Obviously such a large accomplishment will not be left long in the hands of a committee, so the one appointed here last Friday is expected to proceed at once to plan



WILLIAM KNUDSEN, defense commissioner (center), Rear Admiral J. H. Towers (left), and William Brown are inspecting a forged steel motor frame machined with Kennametal tools at Wright Aeronautical Corp.'s plant at Paterson, N. J.

a working organization. Those named on the committee are:

Alvan Macauley, chairman of board, Packard Motor Car Co.; Edsel Ford, president, Ford Motor Co.; K. T. Keller, president, Chrysler Corp.; C. E. Wilson, acting president, General Motors Corp.; C. C. Carlton, vice-president-secretary, Motor Wheel Corp., and L. D. Adams, vice-president, Associated Spring Corp. (alternate).

Representatives of motor truck makers and body companies are to be designated. From the tool and die industry, representatives sat in on the afternoon session and pledged support to the undertaking.

The committee was asked by Knudsen to work with representatives yet to be named from the aviation industry. Immediate work will consist of:

1. Inspection of airplane plants making types of planes involved in the new automotive assignment to get an overall picture of the manufacturing methods now employed.

2. Detailed study of plane parts and blueprints, in cooperation with airplane manufacturers, to determine what production changes may be possible to change the work from bench work to machine operation.

3. Survey of automotive equipment available, particularly for die work and stamping.

4. Survey of plant facilities available for sub-assembly of wings, tails, control surfaces such as rudders, ailerons, etc.

5. Investigation of forging facilities for aluminum and steel, and study of machining facilities available.

It has been indicated that the work will be decentralized, with present plants, machines and labor sources used to avoid loading any further demands for materials and machines onto the demands that already exist.

Of particular interest to potential suppliers is the word that lists used by purchasing agents in the auto industry will be used to find extra sources of supply. It has been indicated, although not stated officially, that jobbing shops (stamping and forging, also machine shops) will be sought out to handle part of the production. The new setup will serve as a clearing house for information about individual shops able to do the kind of work required.

Entirely aside from the defense commission plans revealed here Friday, another $55,000,000 to $60,000,000 in aircraft parts orders was poured into Detroit on Friday, bringing the total aviation stamping contracts here to more than $70,000,000. Initially, Briggs Mfg. Co. entered this phase of the business last summer, contracting with Vought-Sikorsky for manufacture of tails for airplanes. At the same time Murray Corp. of America entered negotiations with plane manufacturers. Both firms have been engaged since in studies and in training men to act as foremen and inspectors. Samples of Briggs-made parts (and Glenn L. Martin forgings) were exhibited to the men at the meeting here with Knudsen.

The private contracts were placed by Douglas Aircraft Co., with the bulk of $75,000,000 in subcontracts placed with Briggs, Murray and the Fisher division of General Motors, all auto body builders. It was reported that Murray's contract will be about $26,000,000 and Briggs' about $20,000,000. Specifically, the Murray job is said to consist of production of wings for about 1700 twin-engine bombers. This relatively small output (compared with the 12,000 plane project) will require employment of 10,000 men and will tax the facilities of a 500,000 sq. ft. aircraft section being tooled in the Murray plant. The 3400 wing panels required will include more than 100 parts each, riveted into assemblies.

Also announced last week was the final placing of an order for the 4000 Pratt & Whitney engines which Ford is going to make. This deal, involving also the War Department and the Navy, totals about $125,000,000 or about $60,000,000 more than the domestic order for Rolls Royce engines which Ford turned down, finally to be awarded to Packard.

Ultimate effects on the 1942 auto model program are not clear yet, although the Knudsen session with auto executives did offer considerable clarification.

First of all, the half billion dollars in airplane parts contracts will not be placed before spring, because the design of the bigger plane must be "smoothed out" and because a great deal of planning, tooling, etc., must be done first. (Even in the case of Murray, which has been negotiating and planning for months, next spring will be the starting time.) By that time, auto builders can get most of their tool and die work done for 1942. The tool and die industry, currently not at all busy, has indicated that it won't even be necessary to make an early start, to get under the wire.

Secondly, there is every indication that a large amount of the stamping equipment in the industry will see service in the airplane program. Forging equipment, machine tools, men—all are to be borrowed from their regular operations to be used for defense work. There may be a shortage of producing equipment, instead of an inability to get new tools!

Third, assuming that new tools, sufficient for quite extended changes, can be obtained by next fall, and that necessary machines will be available, there appears now the imminent probability that machines and other equipment, and men, must go on a third shift, even longer hours, to get done all of the necessary work.

To this question and others related to the subject, Knudsen says: "Let us wait until the contracts are allotted next spring. Perhaps we can superimpose this job upon the present facilities."

Defense Homes Corp. Organized Under RFC

Washington

• • • **Capitalized at** $10,000,000, the Defense Homes Corp. has been created under the Reconstruction Finance Corp. to assist in the job of providing housing in localities where expanding industrial facilites result from the defense program. The corporaton, whose capital is being supplied by Federal Loan Administrator Jesse Jones from funds allocated by the President for the purpose, will work closely with the Federal Housing Administration, the Federal Works Agency, the Defense Housing Coordinator and the War and Navy Departments.

Government Contracts

• • • **Awards by** government agencies for the week ended Oct. 19 totaled $163,368,740. Among contracts of more than $15,000 were:

Iron and Steel Products

Lukens Steel Co., Coatesville, Pa., steel plates, $889,024.
Worth Steel Co., Claymont, Del., steel plates, $1,343,095.
Jones & Laughlin Steel Corp., Pittsburgh, steel bar, $86,281.
Superior Valve & Fittings Co., Pittsburgh, valves, $19,846.
The Greene-Wolf Co., Inc., Brooklyn, N. Y., unions, $43,052.
United States Pipe & Foundry Co., Philadelphia, water pipe, $29,519.
L. E. Stevens Co., Cincinnati, piping system, $20,985.
Barnard Aviation Equipment Co., Inc., Wilkes-Barre, Pa., bolt and bracket, $24,390.
The W. L. Maxson Corp., New York, telescope mounts, $139,658.
The Hadley Special Tool Co., Inc., Boston, sight leafs, $19,761.
Leroy Automotive Distributors, New York, motor mainten. equip., $16,719.
J. R. Hunt & Co., Baltimore, Md., motor mainten. equip., $21,841.
Wm. Scrimgeour, Washington, D. C., openers, knives, $48,182.
Wickwire Spencer Steel Co., New York, tinplate, coke, $26,828.
International Silver Co., New York, steel tableware, $55,700.
Parish Pressed Steel Co., Reading, Pa., reel, $95,562.
American Rolling Mill Co., Middletown, Ohio, steel, $24,807.
A. Dierks & Co., Inc., Brooklyn, N. Y., heating equip., $17,380.
Bethlehem Steel Co., Bethlehem, Pa., hawsers, $105,828.
Oliver Iron & Steel Corp., Pittsburgh, bolts and nuts, $49,218.
Carnegie-Illinois Steel Corp., Washington, D. C., steel, $4,980,464.
Foster Wheeler Corp., New York, boiler, $128,137.
American Cast Iron Pipe Co., Birmingham, Ala., water pipe, $22,532.
Kennedy Mfg. Co., Van Wert, Ohio, tool kits, $53,279.
Aerial Machine & Tool Corp., New York, drag assemblies, $19,200.
Chas. W. Ozias, Oper. Recr., The Patterson Tool & Supply Co., Dayton, Ohio, screwdriver, $20,353.
Republic Steel Corp., Chicago, steel, $18,518.
Gussack Machined Products, Inc., Long Island City, N. Y., mast base, $66,571.
Leach Co., Oshkosh, Wisc., reel unit, $150,900.
Gar Wood Industries, Inc., Detroit, reel unit, $191,817.
The Midvale Co., Philadelphia, forgings, $21,429.
The Eastern Rolling Mill Co., Baltimore, sheet steel, $27,445.
The Electric Heater Co., Bridgeport, Conn., steel barrels, $156,232.
Koppers Co., Bartlett Hayward Div., Baltimore, slide gates, $252,000.
Lakeside Bridge & Steel Co., Milwaukee, steel towers, $105,845.
Jos. T. Ryerson & Son, Inc., Chicago, steel sheet, $24,958.
Rudolph West Co., Washington, D. C., files, $19,783.
American Bridge Co., Boston, Mass., structural steel, $26,200.
The Timken Roller Bearing Co., Canton, Ohio, steel, $17,142.
Reeves Steel & Mfg. Co., Dover, Ohio, corrugated cans, $19,200.

Non-Ferrous Metals and Alloys

The R. Wallace & Sons Mfg. Co., Wallingford, Conn., forks and spoons, $76,875.
Kennecott Sales Corp., New York, copper, $57,840.
The Aluminum Cooking Utensil Co., New Kensington, Pa., stock pots, $58,039.
Aluminum Products Co., LaGrange, Ill., stock pots, $149,742.
International Nickel Co., Inc., New York, nickel, copper, alloy, $44,438.
The American Brass Co., Waterbury, Conn., brass forgings, $15,327.
The International Nickel Co., Inc., New York, nickel, $38,592.
E. Bers & Co., Philadelphia, lead antimony alloy, $28,250.

Other Machinery

The Acme Machine Tool Co., Cincinnati, Ohio, lathes, $26,136.
Hydraulic Controls, Inc., Chicago, Ill., hydraulic steering, $66,379.
Lidgerwood Mfg. Co., Elizabeth, N. J., winches, $34,596.
J. I. Case Co., Racine, Wis., tractors, $18,795.
Caterpillar Tractor Co., Peoria, Ill., tractor, $23,720.
Cincinnati Milling Machine & Cincinnati Grinders, Inc., Cincinnati, Ohio, milling mch., $20,129.
Cincinnati Milling Machine & Cincinnati Grinders, Inc., Cincinnati, Ohio, milling machines, $57,571.
Kearney & Trecker Corp., Milwaukee, Wis., milling mchs., $31,151.
Rockford Machine Tool Co., Rockford, Ill., planer, $18,774.
Brown & Sharpe Mfg. Co., Providence, R. I., milling mchs., $52,656.
McKiernan-Terry Corp., Harrison, N. J., crane machinery, $56,570.
Westinghouse Elec. & Mfg. Co., Knoxville, Tenn., heaters and evaporators, $53,885.
The C. H. Gosiger Machinery Co., Dayton, Ohio, drill press, $17,535.
Pump Engineering Service Corp., Cleveland, Ohio, vacuum pump, $17,212.
Northwest Engineering Co., Chicago, Ill., draglines, $46,035.
Waterbury Tool Div., Vickers, Inc., Waterbury, Conn., gears, $126,078.
Coolerator Co., Duluth, Minn., refrigerators, $405,800.
Western Electric Co., Inc., New York, telephone equip., $434,299.

No Steel Shortage Is Likely, Girdler Says

• • • **No real shortage** of steel for any purpose confronts the United States, Tom M. Girdler said last week at Cleveland.

"The United States has a rated productive capacity of nearly 83,000,000 net tons of ingots a year," said the Republic Steel Corp. chairman. "We are exporting at the rate of nearly 12,000,000 tons and using another 8,000,000 tons for defense purposes. The highest estimate I have seen for domestic consumption is 62,000,000 tons. That would be 25,000,000 tons more than the annual average of domestic use of the last 10 years.

"The figures of commercial and domestic consumption and of exports add up to about 82,000,000 net tons, which is still a million tons less than our rated productive capacity. Great Britain is now getting over one half of all our steel exports and I am sure we can continue to send her all the steel she wants without harm to our own defense needs.

Speculative buying which might create an artificial shortage is contributing to the present high rate of steel production," Mr. Girdler said. "The practical way to deal with a war emergency," he added, would be to "allocate to military purposes all the steel production required, temporarily curtailing other less vital uses of steel."

Bethlehem's Views On Hillman Talks

Washington

• • • **Aides in the** office of Sidney Hillman, labor representative on the National Defense Advisory Commission, said this week that Mr. Hillman planned to meet soon with Eugene G. Grace, president of Bethlehem Steel Co., to discuss pending controversies between the company and the CIO and possibly to find a basis for union recognition by the company.

It was said at the defense commission that the projected meeting would possibly take place on Thursday of this week, or some date yet to be determined next week. Secretary of Navy Frank Knox was represented as being instrumental in arranging the conference.

In a prepared statement given out Monday evening the Bethlehem Steel Co. said that in response to inquiry regarding reports of conferences between Bethlehem officials and Sidney Hillman "the only conferences held between Mr. Hillman and any Bethlehem officials have been those attended by J. M. Larkin, a vice-president of the Bethlehem Steel Co." The statement continued:

"Those conferences were held at the request of Mr. Hillman in his capacity as a member of the defense commission, a Government official, and such conferences dealt with labor matters in which the defense commission was interested.

"In the conferences Mr. Hillman did not purport to act as the representative of any specific labor organization, nor did Mr. Larkin deal with him as such.

"Bethlehem officials, of course, are always ready to meet with various members of the defense commission in all problems of national defense that may be presented by it."

SWOC Leader Opposes Lewis, Indorses F. D. R.

• • • Clinton S. Golden, Pittsburgh regional director of the Steel Workers Organizing Committee, this week indorsed President Roosevelt for reelection, telling union members that the "best interests of the wage earners and the common people" would be served by Roosevelt's return to the White House.

Mr. Golden's statement was one of many issued by CIO union leaders opposing and supporting John L. Lewis' appeal for all working men to vote for Wendell L. Willkie.

↓ ↓ ↓

Cleveland

• • • **Meetings have** been held between Republic Steel Corp. officials and representatives of the C.I.O. on the question of back pay for strikers arising from the 1937 labor dispute, but up to late Tuesday of this week the basis of arranging payment was believed still unsettled.

Both T. M. Girdler, Republic chairman, and R. J. Wysor, president of the company, were away from Cleveland Tuesday. A report that they were in conference with John L. Lewis on that day was declared unfounded. Some authorities in the steel industry at Cleveland expressed the viewpoint it was a matter of regret that grave national campaign issues should be subordinated to a single issue between labor leaders.

Machine Tools Ready As Needed, Berna Says

Cleveland

• • • **Machine tool** production for 1940 will be 20 times larger than that of the depression year of 1932 and two and one-half times larger than that of the boom year of 1929, Tell Berna, general manager of the National Machine Tool Builders' Association, predicted Monday, Oct. 28, in an address before the American Society of Tool Engineers at the Homestead Club, Endicott, New York.

"The manufacturers of the United States are going to get the machine tools they need for national defense production," Mr. Berna said, "but they can't get them all at once. I am confident that machine tools will be at hand as rapidly as they can actually be put to work."

U. S. Steel Quarterly Profit $33,103,067

• • • **Export shipments** of U. S. Steel Corp. are running in excess of 16 per cent of all shipments with more than half of all export deliveries going to Great Britain, Irving S. Olds, chairman of the board, reported in an interview Tuesday following the regular quarterly meeting of the board of directors. Exports for the first nine months of the present year were about 16 per cent of all shipments.

Ingot operations in the third quarter averaged 88 per cent of capacity, Mr. Olds stated, and current operations were "slightly above the national rate" of 95.7 per cent (Institute estimate). Incoming business is just about equal to deliveries and backlogs represent approximately two months' operations.

Shipments of steel directly for defense program purposes account for only a very small proportion of the corporation's business at present, the board chairman said.

Net profit of the corporation in the third quarter was $33,103,067, highest since the second quarter of 1937 when profit was $36,173,682. Net profit in the second quarter of the current year was $19,201,008 and in the third quarter of 1939 was $10,420,445.

Profit for the first nine months of 1940 was $69,418,070, as compared with $12,390,756 in the comparable period of 1939. The directors declared the regular quarterly dividend of $1.75 on the preferred stock and a dividend of $1 per share on the common stock.

Shipments of finished steel in the September quarter were 4,145,329 net tons, equal to 85.2 per cent of the corporation's finishing capacity. This was an increase of 29 per cent over shipments in the second quarter and 53 per cent over the third quarter of 1939.

Mr. Olds stated that no subsidiary of the corporation had followed the Pittsburgh Coke & Iron Co. in raising iron prices. Questioned on first quarter prices he said it was too early to discuss that matter.

No new expansion of facilities, other than those already made public, are planned by the corporation, the chairman said.

Defense Theme Dominates Metal Congress

(CONCLUDED FROM PAGE 47)

Elizabeth, N. J., for distinguished service to metallurgy. Mr. Machlet is noted for his gun-bluing process perfected several years before the World War; for his development of nitriding and ni-carbing; for developing direct gas carburizing and for clean hardening. Mr. Machlet, who was 76 years old Oct. 24, one day after the award was made, was unable to attend the A.S.M. meeting, but P. C. Osterman of American Gas Furnace Co., substituted for him. The A.S.M. awarded its Houston chapter its bell for outstanding work. The A.S.M. announced a program for free training for inspectors in defense industries.

At the opening session of the A.W.S. the Lincoln Gold Medal for 1939-1940 was presented to H. J. French and T. N. Armstrong, Jr., of the International Nickel Co., Inc., as previously reported, and the Samuel Wylie Miller Memorial Medal was awarded William Spraragen, technical editor of the A.W.S. and editor of the Welding Journal.

First annual award of the prizes by the Resistance Welder Manufacturers' Association also took place at the opening session. They are: First prize of $300 for paper "Electro-Magnetic Stirring Action in a Spot Weld," by A. M. Unger, H. A. Matis and W. A. Knocke of Pullman Standard Car Mfg. Co.; Second prize of $200 for paper "Fundamentals of Resistance Welding," by R. S. Pelton, General Electric Co.; Third prize of $100 for paper "Resistance Flash Welding of Strip in Steel Mills," by J. H. Cooper of the Taylor-Winfield Corp.; Fourth prizes of $25 each were presented H. C. Cogan, National Electric Welding Machine Co. and R. S. Pelton, General Electric Co.; C. F. Marschner, McDonnell Aircraft Corp.; R. J. Wensley, I.T.E. Circuit Breaker Co.; Prof. W. B. Kouwenhoven, Johns Hopkins University, and J. Tampico, graduate student.

New officers of the Welding Society include: Col. Glen F. Jenks, Ordnance Department, U. S. Army, president for 1940-41; Klaus L. Hansen, consulting engineer, Harnischfeger Corp., Milwaukee, first vice-president; and David Arnott, long prominent in the American Bureau of Shipping, second vice-president.

Officers named by the A.S.M. include: Dr. Oscar E. Harder of Battelle Memorial Institute to succeed James P. Gill as president; Dr. Bradley Stoughton, Dean Emeritus of Lehigh University, vice-president; William H. Eisenman, reelected secretary, and Dr. Kent R. Van Horn, of Cleveland, who continues his term as treasurer.

For the most meritorious paper on wire manufacture and fabrication during the year Robert W. Sandelin, metallurgist, Atlantic Steel Co., Atlanta, Ga., was awarded the Wire Association Medal. Mr. Sandelin's paper presented Wednesday was on the subject of "Galvanizing Characteristics of Different Types of Steels." In 1937 he was a joint winner of honorable mention for a paper on "Factors Affecting the Quality of Galvanizing."

In his latest paper Mr. Sandelin presented data from a series of galvanizing experiments in which he gathered material on appearance, bend tests and strip tests on over 200 samples. Metallographic experiments were made to determine the nature of various types of coatings, followed by work to determine the difference in the diffusion rates of the various steels.

Honorable mention this year was awarded H. Blount, Point Breeze Works of Western Electric Co., and J. D. Wiltrakis, Kearney Works of Western Electric Co., for their paper on "Design and Operation of a New Copper Wire Drawing Plant." Mr. Blount's paper covered the principal features in connection with the design of high speed copper wire drawing machines, while Mr. Wiltrakis covered the facilities provided at the Kearney plant for drawing wire at speeds up to 1200 f.p.m.

At the annual breakfast sponsored by the Industrial Gas Section of the American Gas Association, under the direction of Eugene Milener, editors of industrial magazines heard Dr. Stoughton discuss world problems. The editors participated in a novel game of chance devised by Harry W. Smith, Jr., of the Association.

There were numerous breakfast parties arranged by various groups of the four associations participating in the Metal Congress.

The annual meeting of the industrial research division of the welding research committee of the A.W.S. in cooperation with The Engineering Foundation was held Oct. 21. Dr. C. A. Adams, committee chairman, briefly reviewed the committee's work in past years. Col. Glen F. Jenks then called for reports of current progress on projects covering a very wide range of subjects, including resistance welding; weldability of border line steels; corrosion tests on high alloy steels; effect of arc length on nickel alloys; fatigue strengths in butt welded bridge joints; non-destructive tests and many other phases. At the meeting Dr. W. O. Hotchkiss of Rensselaer Polytechnic called for greater cooperation between industry and educational institutions in research.

Photo by Harris & Ewing

TICKLER'S TANK—This home-made armored car, built of scrap plates around a 1935 25 hp. Sunbeam car chassis, was designed and constructed by Col. Tickler's L.V.D. battalion, a home defense unit in England. The tank carries three machine guns.

Engineers Focus Attention on Bessemer Steel

(CONCLUDED FROM PAGE 53)

sliding valve in the hopper. An effort is made to maintain a reaction as vigorous as possible by alternately pouring slow and fast. The addition of the mixture is begun immediately upon the appearance of the manganese boil from the first shovelful of ferromanganese added. The ferromanganese and the mixture are added concurrently for a few seconds and the adding of the mixture continues for a few more seconds and is completed when about half the blown metal has been poured. The addition usually is completed in about 30 sec. The P is by this time reduced from 0.095 or 0.1 per cent to 0.02 to 0.04 per cent.

In operations at Benwood the slag is separated from the blown metal in both normal and dephosphorized grades to obtain the benefit of higher Mn efficiency. The Mn efficiency obtained when dephosphorizing mixtures are used is about 65.7 per cent with the regular phosphorus grades, and 69.8 per cent with the low phosphorus steels.

It was found that when normal and low phosphorus grades were produced alternately in the same ladle a major attack of the ladle lining in regular practice resulted. It was decided to develop one ladle lining for both grades rather than attempt to use a number of ladles. The most satisfactory lining developed consists of a very hard burned grade of dense clay brick set up with a thin buttered joint of a chrome base material containing a vegetable bonding material. This type of lining usually will stand two to four regular heats followed by six to eight dephosphorized heats before patching is necessary.

The degree of phosphorus eliminated is proportional to the amount of dephosphorizer used, over and above that which is required to neutralize the acid contamination. Typical amounts of dephosphorizer mixture used at Benwood is shown in the following table:

Phos. Spec.	Wgt. of Mixture per 6.5-ton heat	Lb. per Ton
0.035%	500 lb.	78
0.040	450	70
0.050	400	62
0.065	350	54

About 100 lb. of dephosphorizer is required to neutralize the acid materials present and no dependable phosphorus reduction is effected until 150 lb. is used. On the high phosphorus irons (0.147 to 0.192 P), 500 lb., of dephosphorizer is used in each 6.5-ton heat. The P content of the steel in these cases ranged from 0.06 to 0.076 per cent.

Discussing the hot working properties of dephosphorized steel, Mr. Yocom said that it was superior to the untreated normal phosphorus product. The treated steel was never red short in the low and medium ranges of manganese and the surface quality was consistently good, even in steels with 0.18 to 0.25 Mn. This quality permits the use of low metalloid steel to cold reduced grades where a low manganese content has advantages. Skelp of 0.25 Mn and low P is regularly processed into butt weld pipe without biting off at the tongs.

The dephosphorized ingots are softer than the regular product at normal rolling temperatures, Mr. Yocom found, and will withstand heavier reductions in the breakdown passes without cracking. The use of dephosphorized steel also results in increases in blooming mill tonnages and ingot to billet yields, it was also discovered. A comparison of physical properties of open hearth and low P bessemer is given in Table 2 (abstracted from data contained in table presented with Mr. Yocom's discussion). The open hearth material in the tests covered by the table was rimmed steel and the low P was capped and keyed. The bessemer heats were selected to show the influence of various amounts of P.

With reference to butt weld pipe, it was indicated that routine tensile tests showed that low P grades ran consistently below the normal P steels. Pipe in the range 0.02 to 0.04 P had a yield point of 36,000 lb., an ultimate strength of 55,000 lb. and an elongation of 29 per cent in 8 in. In the normal range, 0.09 to 0.1 P, the yield strength was 40,000 lb., ultimate strength was 62,000 lb. and elongation was 24 per cent.

The low P steel gives an excellent account of itself in pipe products, Mr. Yocom said, where a soft ductile material of good welding and threading quality is essential such as ammonia pipe, coiling and bending pipe, electrical conduit, tubing for oil, gas and water wells, etc. In electrical conduit the welding and threading quality is superior to an open hearth steel and the desired low bending stress is obtained. In well tubing the application of sudden shocks are a cause of breakage in high P steel and upsetting at the coupling end in open hearth steel. Since the application of low P bessemer to this work, no complaints involving failures of this type have been received.

Another session at the engineers' meeting that attracted considerable interest was the round table discussion on electropolishing of metals from both the metallographic and commercial angles. A report of this meeting, which was presided over by Sam Tour and Hugh E. Brown, will be published in a succeeding issue of THE IRON AGE.

Table I—Bessemer and Open-hearth Production—Net Tons

Year	Bessemer	Open-hearth	Ratio Bessemer to Open hearth
1886	2,541,493	245,250	10.36
1890	4,131,536	574,820	7.19
1895	5,498,223	1,273,644	4.32
1900	7,486,942	3,805,911	1.97
1905	12,254,340	10,047,941	1.22
1910	10,542,305	18,485,050	0.57
1915	9,281,679	26,520,594	0.35
1920	9,949,057	36,592,522	0.27
1925	7,530,837	42,598,627	0.18
1929	7,977,210	54,155,235	0.15
1930	5,639,714	39,255,073	0.14
1932	1,715,925	13,336,210	0.13
1935	3,175,235	34,401,280	0.092
1939	3,358,916	48,409,800	0.070

Figures taken from records of the American Iron and Steel Institute.

Table II—Comparison of Physical Properties of Bessemer and Open-hearth Steel

(Average in each example of three Blows)

Blow	Type	Analysis C	Mn	P	S	Yield lb. per Sq. In.	Ultimate Strength lb. per Sq. In.	Elong. % in 2 in.	Rockwell B Scale
A	Bess.	0.07	0.41	0.06	0.05	41,829	57,033	30.0	66.2
B	Bess.	0.05	0.27	0.049	0.047	42,955	55,127	30.0	63.7
C	Bess.	0.04	0.26	0.043	0.046	42,643	54,890	30.7	62.4
D	Bess.	0.05	0.28	0.025	0.04	40,870	52,836	33.2	61.2
E	O. H.	0.08	0.41	0.024	0.033	38,367	52,560	35.3	55.2

Welders Debate Year's Progress

(CONTINUED FROM PAGE 54)

ed that the combination of flame hardening and Meehanite has opened up new fields of application since the core had damping properties and the hardened surfaces have small graphite nuclei which form reservoirs for lubricant.

Prior to flame hardening of steels, residual stresses must be reduced to a minimum by proper heat treatment. In most cases, an anneal, normalize or liquid quench with a draw of over 1200 deg. F. is necessary, the authors state. Meehanite is stress relieved at 1200 deg. Careful inspection of material is required, as any seams, laminations and inclusions will open up during the flame hardening process. Abrupt changes of section are to be avoided, as are drilled and tapped holes. These can be filled with carbonaceous material or graphite plugs.

Distortion or warpage often takes place as a result of flame hardening. This can be reduced: (1) by cooling the piece with water; (2) by machining the piece in such a way that the distortion will pull the work into the desired shape; (3) by actually springing the work in the opposite direction when flame hardening, or (4) by increasing the mass in the sections to be flame hardened to give greater stiffness and then removing the extra material from the back side after hardening. Corrective machining prior to flame hardening or springing the work is very effective on repetitive operations.

Proper procedure and equipment are important factors in the success or failure of flame hardening, but the authors believe the deciding element is the ability of the operator. The most suitable men for this work at Farrel-Birmingham were young men who had worked in the laboratory doing routine analysis for a few years. Their knowledge of metallurgy made them conscious of changes that might occur due to minute variations of operation or procedure. The original paper is illustrated with numerous examples of typical machine parts flame hardened by the company.

Electro Brazing Methods

WIDE use of electro-brazing methods is being made in the manufacture of copper switchgear parts by the I. T. E. Circuit Breaker Co., it was indicated by R. J. Wensley, assistant general manager. Five years ago, the few brazing operations in the plant were done with acetylene torches. Today the firm has five electric resistance transformers ranging in capacity from 25 to 150 kva. Heat is generated by carbon blocks placed against the work in what amounts to a typical resistance welding press. As a result of the availability of the equipment, many joints in non-ferrous metal previously riveted or bolted and soft soldered were redesigned for electro-brazing.

Mr. Wensley brought out that by using materials of different melting points as brazing material it is possible to build up progressive assemblies in two or three steps. His company uses Easy-Flo, Sil-Fos and phos-copper, the respective working temperatures being 1200, 1325 and 1500 deg. F. These alloys are used in sheet form of various thicknesses, or in stick or powder form. The phos-copper is used only where the joint surfaces are relatively large.

Soft soldering is done in the same type of machines, using somewhat lower current and much lower temperatures. For this work half-and-half solder powdered to 200 mesh and mixed with a liquid flux is used. Some jobs have been soft soldered in this way in a quarter of the time required with gas torches and stick solder.

Spot Welding Brass

AN exhaustive research paper on all the factors involved in the spot welding of silicon brass was given by M. L. Wood, J. Babin and O. B. Atkin, Chase Brass & Copper Co. Welds were tested in torsion, failure being in circular shear about the axis of the spot. The alloy investigated contained 77 per cent copper, 1 per cent silicon and 22 per cent zinc.

Surface preparation has been found to be a highly important variable from the viewpoint of commercial brass for spot welding. Silicon additions to the brasses alter the character of the annealing scale tremendously and introduce new difficulties in cleaning. Tests showed that uniformity of resultant surface is of more importance in preparation of sheet for spot welding than any other consideration. Chloride dipping was found to be most effective.

The authors recommend flat points of high conductivity in spot welding of silicon brasses. Points of low conductivity material resulted in weld zones extending clear through both sheet thicknesses, and the welds were all unsound and of low strength and ductility. With flat points of high conductivity unit electrode pressures around 15,000 lb. per sq. in. welds of uniform strength can be made at low points. For metal gages in the range of 0.020 to 0.060 in., for instance, about 22,000 secondary amperes will give the maximum strength with 3/16 in. flat points. Welding time should be greater than four cycles as unsoundness results below this time; on the other hand, time in excess of eight cycles tends to give point trouble. Six cycles is a good compromise, the authors concluded, considering all factors. The upper limit of gages that can be spot welded is not known. There is evidence to show that complications can be expected due to high vapor pressure of zinc in the alloy and the concentration of heating effects in certain areas in the weld.

Two other engineers of the Chase Brass & Copper Co., J. J. Vreeland and J. Babin, gave considerable useful information on acetylene and carbon arc welding of copper and red brass. Most of the trouble encountered with copper welding has been due to the type of copper used. Electrolytic copper, containing a small percentage of oxygen in the form of copper-cuprous oxide eutectic, cannot be generally joined by any method of welding that involves a high percentage of reducing gases. Success can readily be obtained, however, by using deoxidized copper instead. Electrolytic copper can be successfully welded by carbon arc welding, on the other hand. Satisfactory welding of red brass can also be done by the carbon arc, but the authors strongly recommend the use of high silicon bronze welding rod, although for gas welding, to avoid dezincification of the red brass, a welding rod containing high percentages of copper and low silicon is recommended.

Spot Welding Passenger Cars

ONE of the problems of fabricating the new streamlined passenger cars whose sides are free of projecting rivets is to prevent buckling of the steel panels when they are spot welded. Each spot weld shrinks a certain amount because when metal expands upon heating between spot welding electrodes, it upsets the metal around the outer edge of the weld since the cold metal surrounding the spot restricts side expansion. Upon cooling, the upset metal cannot return to its original position and the dimension of the weld reduces slightly. A panel that is surrounded by a row of spot welds therefore has its outer edge shortened and a bulge is created in the

panel. For a panel 17 in. in width, a reduction in side length of only 0.01 in. will produce a ¼ in. buckle.

Peening of the spot welds will eliminate the buckles, but is a slow process for production work. Instead at the Pullman-Standard Car Mfg. Co., as reported by A. M. Unger, development engineer, buckles are prevented by spot welding a light gage corrugated stiffener to the back of the outside panels. These stiffeners must be spaced, of course, so as to allow space for the framing members. After the stiffeners are spot welded, the various sections of the car side are joined by seven vertical butt welds to form a single panel. This welding is accomplished by the Unionmelt automatic electric arc process. Spot welding of the completed side panel to the arc welded frame is done with the aid of a huge jig supporting a copper backing plate 8 ft. 10 in. high and 85 ft. long. By employing a single plate instead of individual back-up bars, great flexibility in application to the fabricaton of different car designs is obtained. The copper plate eliminates the indentations of the electrodes on the outside sheets.

Tank Car Construction

BECAUSE of the necessity of exploring welds by the X-ray process and of stress relieving the entire tank as a unit, welded tank cars are much more expensive to build than riveted cars but are justified because they can be made absolutely leakproof and have a smooth interior, free from rivet heads. The latter consideration is important in tanks that are to be lined with lead or rubber. Reviewing the welding of tank cars since the 1880's, when roll welding was first tried, John W. Sheffer, electrical engineer, American Car & Foundry Co., indicated that his company began welding steel tanks by the automatic electric process back in 1924. At the Milton plant, the Unionmelt process of automatic arc welding is used for steel tanks and in his paper, Mr. Sheffer described this process at some length.

In the construction of aluminum tanks, on the other hand, the Electronic Tornado shielded automatic carbon arc process is used. The automatic process in this instance permits faster construction and a considerably better quality weld, together with marked freedom from distortion. The welding time per tank is considerably shorter than on previous methods since the automatic weld is made in two passes instead of three formerly used. Costs are practically unchanged, however, because of increased flux cost. Quality is greatly improved.

Operator Training

IT was evident from the amount of discussion that followed the presentation of a paper on training of welding operators that this problem is a major one facing the welding industry today. The speaker, Dr. S. Lewis Land, supervisor of industrial education, N. Y. State Education Department, Buffalo, placed great emphasis on the selection of trainees. If proper care is taken in the selection of persons to be trained, the development of first class welders is assured. Other factors involved are proper equipment in the schools, which he said should be the most up-to-date equipment available, and qualified instructors. The man who teaches the actual shop work should be first of all a thoroughly qualified welder and then he must be a good instructor. The man who teaches related classroom instruction should be first of all a good engineer.

Dr. Land thought that a welding operator could be trained in 100 to 400 hr. of actual shop experience, the lower figure applying to a man with some previous trade experience. Much of the comment from the floor was directed against the so-called back alley schools that are turning out men with 40 to 50 hr. of welding practice. High fees are charged and the men are usually unemployable except after considerable training on the job. The State of New York is investigating such private schools at the present time. Meanwhile, within the past few weeks, the President signed a bill authorizing an additional $60,500,000 for trade training. This money will be available to schools acceptable to the government.

The American Welding Society is planning to investigate the shortage of welding operators and the training facilities available in the various sections in which the society is represented.

Semi-Finished Steel Exports 353,448 Tons in September

Washington

• • • **Non-alloy** raw and semi-finished steel exports in September totaled 353,448 tons, of which the United Kingdom took 312,949 tons and Japan 10,709 tons. In the first nine months of the current year exports of this material, consisting of ingots, blooms, billets, slabs, sheet bars and tin plate bars, totaled 1,590,071 tons.

Exports of heavy rails in September totaled 25,135 tons and during the nine months of 1940 they were 147,831 tons. Plain structural steel exports were 69,470 tons and 275,022 tons, respectively.

Exports of scrap in September totaled 251,116 tons and for the nine months 2,393,292 tons. Leading other countries, Japan took 148,332 tons in September, while shipments to the United Kingdom were 75,049 tons. Pig iron exports in September aggregated 84,677 tons and during the nine-month period 408,351 tons. Of the September exports 82,744 tons went to the United Kingdom.

Imports of iron and steel in September rose to 2542 gross tons from 2089 tons in August, according to preliminary figures of the Metals and Minerals Division, Department of Commerce.

In the nine months ended Sept. 30, imports totaled only 46,809 tons compared with 240,964 tons in the corresponding period of 1939. Of the 1940 nine-month imports, pig iron was the leading product, totaling 9554 tons, followed by spiegeleisen, 9213 tons, and ferromanganese, 8530 tons.

A.S.T.E. Taking Reservations For 1941 Tool Show

• • • **Applications for reservations** for the 1941 Machine & Tool Progress Exhibition are now in the mails, according to an announcement by Ford R. Lamb, executive secretary, American Society of Tool Engineers, Detroit, sponsors of the show. To be held in conjunction with the 1941 annual convention of the A. S. T. E. the week of March 24, the exhibition will be devoted to displays of new equipment and methods designed to expedite production, particularly from a national defense standpoint. The exhibit committee for 1941 is composed of Frank A. Shuler, Chrysler Corp., chairman; Frank R. Crone, Lincoln Motor Co.; William H. Smila, Chrysler Corp., and Luke E. Beach, General Motors Corp.

• **S. J. Horrell** has been appointed vice-president, Power Piping division, Blaw-Knox Co., Pittsburgh. Mr. Horrell has been associated with this company since May, 1939, and has been serving this division in the capacity of sales manager.

• **Harold B. Thomas,** one of the founders of the Elastic Stop Nut Corp., Union, N. J., and vice-president in charge of sales, has resigned to enter consulting work in industrial product analysis and market research. He remains active as a director and member of the executive committee of the corporation.

• **C. E. Wooliever,** assistant personnel director of Buick, has been elected secretary of the Automotive and Machine Shop section of the National Safety Council at the recent annual meeting in Chicago. Mr. Wooliever directs safety work at Buick.

• **W. M. Black,** who has been associated with American Manganese Steel Division of American Brake Shoe & Foundry Co., Chicago, since 1912, has been appointed president of Amsco. He succeeds **W. E. Crocombe,** who remains as president of the American Forge division, which has undertaken the production of upset shell forgings and the products of the Great Lakes Forge Co., Chicago, recently purchased. Mr. Black became general sales manager of the Amsco division in 1934 and the following year was made a vice-president.

Personals

Change is inevitable in progressive Industry. Change is constant.

• **George W. Curtis,** since 1930 Milwaukee district manager of the industrial division of Timken Roller Bearing Co., Canton, Ohio, has been appointed division manager for the company. Industrial and automotive bearing sales as well as alloy steel sales activities in the Milwaukee district will be under his supervision. He was graduated in 1920 from Carnegie Institute of Technology and served in engineering and sales capacities at Canton and Pittsburgh, before being transferred to Milwaukee.

• **Harry Gay** has been made chief engineer of the Power Piping division. He has an extensive technological background in the fields of paper and pulp processing, power plant engineering and hydraulics.

• **Joseph Pulte** has been named vice-president and general manager of Detroit Steel Corp. **Anton Pulte** has been named vice-president in charge of mill operations, **Max Vivian,** vice-president in charge of purchases and **Rodger Yoder,** formerly of Ernst & Ernst, as comptroller. At the same time, four vice-presidents were appointed for the Craine-Schrage Co., a subsidiary. They are **Robert D. Kelley, Joseph J. Conlisk, Theodore E. King** and **John G. Palmer.** Mr. Yoder also was appointed comptroller of Craine-Schrage.

• **Hugh Krampe** has been made Chicago district sales manager, with headquarters in the Field Building, of the Shaw-Box Crane & Hoist Division, Manning, Maxwell & Moore, Inc., Muskegon, Mich.

W. M. BLACK, new president of American Manganese Steel Division of American Brake Shoe & Foundry Co.

GEORGE W. CURTIS, Milwaukee division manager of Timken Roller Bearing Co.

HUGH KRAMPE, Chicago district sales manager of the Shaw-Box Crane & Hoist Division, Manning, Maxwell & Moore, Inc.

• **C. B. Nolte,** president of the Crane Co., has been appointed chairman of the annual meeting arrangements committee of Illinois Manufacturers' Association. The 47th annual banquet will be held in Chicago on Dec. 3.

• **L. R. Kells,** heretofore chief engineer of the Salem Engineering Co., Salem, Ohio, has been placed in charge of the furnace department of the Wellman Engineering Co., Cleveland. He has had extensive experience in the design and sale of furnaces and has been associated with Mt. Vernon Bridge Co., Chapman Engineering Co., Surface Combustion Corp., and Askania Regulator Co.

• **H. J. Berman,** formerly with Edison General Electric Co., Chicago, has been appointed works manager of the A. J. Lindemann & Hoverson Co., Milwaukee, according to an announcement from E. A. Lindemann, president. Other changes at Lindemann's are the appointment of H. F. Muenchow, former acting general superintendent, as permanent superintendent; Paul Gerdes, previously with Cleveland, Tenn., Enameling & Stamping Co., in charge of the enameling and stamping division, and Fred Kimes, formerly with Prentiss-Wabers Co., Wisconsin Rapids, Wis., as manager of the sheet metal and welding department.

• **Ralph W. Carney,** president of the Coleman Stove & Lamp Co., Wichita, Kan., speaking before the fall merchandising clinic of the Milwaukee Association of Commerce predicted that "this war business is going to create about five years of a 'fool's' paradise for the United States and there'll be a swell headache when it's all over." He said that defense contracts are neither productive nor reproductive of any economic good to anyone and that companies, like people, have got to be ready for a lot of hard work.

• **R. S. Clingan,** for the past 10 years connected with the Republic Steel Corp., has been appointed Chicago district manager to handle the sale of Aristoloy alloy steels made by the Copperweld Steel Co., Glassport, Pa.

• **Edward A. O'Neal, Jr.,** who has been manager of the Anniston plant of the Phosphate Division of Monsanto Chemical Co., has been transferred to Monsanto's new Trenton, Mich., plant to supervise the operation of the new plant as plant manager, effective Jan. 1.

• **Leo Naber,** formerly associated with Hilb & Bauer, has become a member of the firm of David Joseph, Cincinnati scrap broker and dealer. Mr. Naber will also be associated with the Joseph subsidiary, the Middletown Iron & Steel Co., Middletown, Ohio.

• **Herbert M. Wertz** has been named advertising manager of Toledo Steel Products Co., Toledo. Mr. Wertz was formerly connected with the industrial division of De Vilbiss Co., Toledo.

• **J. B. Manor,** of Weldit Acetylene Co., Detroit, will address members of the Detroit chapter, American Welding Society, at a meeting Nov. 1 on "Safety in the Use of Oxygen and Acetylene." The meeting will be held at 8 p. m. in the Colonial Room, Detroit Leland Hotel.

• **Henry H. Timken, Jr.,** has been elected chairman of the board of Timken Roller Bearing Co., to succeed his father, the late H. H. Timken, Sr. Mr. Timken will continue as vice-president and general manager of the steel division.

Also elected to the board of directors was **John E. Fick,** general superintendent of the steel division, who has been with the company for 20 years.

• **F. L. Curtis,** treasurer of Raybestos-Manhattan, Inc., and general manager of the Manhattan Rubber Mfg. Division, Passaic, N. J., has been elected a director of the Rubber Manufacturer's Association.

• **L. A. Smith,** since 1921 secretary-treasurer of the Pennsylvania Salt Co., Philadelphia, has been elected vice-president and treasurer.

• **Joseph H. Lee,** who has been associated with the Shell Oil Co. for the past 18 years, has been placed in charge of all lubricant sales east of the Rocky Mountains. He will make his headquarters in New York.

• **Walter H. Bowes,** founder and chairman of the board of the Pitney-Bowes Postage Meter Co., Stamford, Conn., has retired from active duty, continuing in the capacity as consultant and advisor.

• **Dr. Lloyd Noland,** chief surgeon of the Tennessee Coal, Iron & Railroad Co., has been made a member of the newly-created subcommittee on industrial medicine of the health and medical committee of the National Defense Advisory Commission.

Obituary

• **Herman W. Schatz,** sales manager of the American Tool Works Co., Cincinnati, died suddenly at his home in that city on Oct. 23. Mr. Schatz, who was 57 years old, had been on leave of absence from the American Tool Works for some time because of ill health.

• **Edward T. Butler,** associated with the American Stove Co. for 40 years, former vice-president of the McDougall-Butler Co., Inc., Buffalo, and also vice-president of the Cleveland Wire Cloth & Mfg. Co., died Oct. 19 in Cleveland. During his career he was manager of the Dangler Stove Co., division of American Stove Co.

• **Harry F. Hildreth,** treasurer and office manager of George F. Wright Steel & Wire Co. for the past 17 years, died at his home in Worcester, Mass., Oct. 23, aged 51 years.

• **Frank Goodrich Feeley,** mechanical engineer, industrial executive and since 1927 general manager of E. D. Jones Co., Pittsfield, Mass., manufacturer of paper mill machinery, died at his Pittsfield home on Oct. 20.

• **John Boyle,** owner of the John Boyle Machine Shop, Peabody, Mass., until his retirement 15 years ago, and one of the best known of the smaller New England machine shop operators, died Oct. 23 at his hunting lodge on Chebacco Lake, Essex, Mass.

• **Charles G. Groff,** chairman of the board of Electrolux Corp. & Servel, Inc., died Oct. 24 in Greenwich, Conn. He was 60 years old. Mr. Groff was an authority on merchandising.

The Iron Age Comparison of Prices

Advances Over Past Week in Heavy Type; Declines in Italics

	Oct. 29, 1940	Oct. 22, 1940	Oct. 1, 1940	Oct. 31, 1939
Flat Rolled Steel:				
(Cents Per Lb.)				
Hot rolled sheets	2.10	2.10	2.10	2.00
Cold rolled sheets	3.05	3.05	3.05	3.05
Galvanized sheets (24 ga.)	3.50	3.50	3.50	3.50
Hot rolled strip	2.10	2.10	2.10	2.00
Cold rolled strip	2.80	2.80	2.80	2.80
Plates	2.10	2.10	2.10	2.10
Tin and Terne Plate:				
(Dollars Per Base Box)				
Tin plate	$5.00	$5.00	$5.00	$5.00
Manufacturing ternes	4.30	4.30	4.30	4.30
Bars and Shapes:				
(Cents Per Lb.)				
Merchant bars	2.15	2.15	2.15	2.15
Cold finished bars	2.65	2.65	2.65	2.65
Alloy bars	2.70	2.70	2.70	2.70
Structural shapes	2.10	2.10	2.10	2.10
Wire and Wire Products:				
(Cents Per Lb.)				
Plain wire	2.60	2.60	2.60	2.60
Wire nails	2.55	2.55	2.55	2.55
Rails:				
(Dollars Per Gross Ton)				
Heavy rails	$40.00	$40.00	$40.00	$40.00
Light rails	40.00	40.00	40.00	40.00
Semi-Finished Steel:				
(Dollars Per Gross Ton)				
Rerolling billets	$34.00	$34.00	$34.00	$34.00
Sheet bars	34.00	34.00	34.00	34.00
Slabs	34.00	34.00	34.00	34.00
Forging billets	40.00	40.00	40.00	40.00
Wire Rods and Skelp:				
(Cents Per Lb.)				
Wire rods	2.00	2.00	2.00	1.92
Skelp (grvd.)	1.90	1.90	1.90	1.90

	Oct. 29, 1940	Oct. 22, 1940	Oct. 1, 1940	Oct. 31, 1939
Pig Iron:				
(Per Gross Ton)				
No. 2 fdy., Philadelphia	$24.84	$24.84	$24.84	$24.84
No. 2, Valley furnace	23.00	23.00	23.00	23.00
No. 2, Southern Cin'ti	23.06	23.06	23.06	23.06
No. 2, Birmingham	19.38	19.38	19.38	19.38
No. 2, foundry, Chicago†	23.00	23.00	23.00	23.00
Basic, del'd eastern Pa.	24.34	24.34	24.34	24.34
Basic, Valley furnace	22.50	22.50	22.50	22.50
Malleable, Chicago†	23.00	23.00	23.00	23.00
Malleable, Valley	23.00	23.00	23.00	23.00
L. S. charcoal, Chicago	30.34	30.34	30.34	30.34
Ferromanganese‡	120.00	120.00	120.00	100.00

†The switching charge for delivery to foundries in the Chicago district is 60c. per ton. ‡For carlots at seaboard.

Scrap:				
(Per Gross Ton)				
Heavy melting steel, P'gh.	$21.50	$21.50	$21.25	$22.50
Heavy melt'g steel, Phila.	20.75	20.75	20.625	21.75
Heavy melt'g steel, Ch'go	19.75	19.75	19.75	18.625
Carwheels, Chicago	20.25	20.25	20.25	17.75
Carwheels, Philadelphia	22.75	22.75	22.75	22.25
No. 1 cast, Pittsburgh	22.25	21.75	20.25	22.75
No. 1 cast, Philadelphia	22.75	22.75	22.25	24.25
No. 1 cast, Ch'go (net ton)	17.75	17.75	17.75	16.25
Coke, Connellsville:				
(Per Net Ton at Oven)				
Furnace coke, prompt	$4.75	$4.75	$4.75	$5.00
Foundry coke, prompt	5.25	5.25	5.25	5.75
Non-Ferrous Metals:				
(Cents per Lb. to Large Buyers)				
Copper, electro., Conn.*	12.00	12.00	12.00	12.50
Copper, Lake, New York	12.00	12.00	12.00	12.50
Tin (Straits), New York	*51.50*	51.625	51.50	55.50
Zinc, East St. Louis	7.25	7.25	7.25	6.50
Lead, St. Louis	5.35	5.35	4.85	5.35
Antimony (Asiatic), N. Y.	16.50	16.50	16.50	16.50

*Mine producers only.

The various basing points for finished and semi-finished steel are listed in the detailed price tables, pages 102 to 110 herein.

On export business there are frequent variations from the above prices. Also in domestic business, there is at times a range of prices on various products, as shown in our detailed price tables.

Composite Prices

	FINISHED STEEL	PIG IRON	SCRAP STEEL
Oct. 29, 1940	2.261c. a Lb.	$22.61 a Gross Ton	$20.67 a Gross Ton
One week ago	2.261c. a Lb.	$22.61 a Gross Ton	$20.67 a Gross Ton
One month ago	2.261c. a Lb.	$22.61 a Gross Ton	$20.54 a Gross Ton
One year ago	2.236c. a Lb.	$22.61 a Gross Ton	$20.96 a Gross Ton

	High	Low	High	Low	High	Low
1940	2.261c., Jan. 2	2.211c., Apr. 16			$20.67, Oct. 15	$16.04, Apr. 9
1939	2.286c., Jan. 3	2.236c., May 16	$22.61, Sept. 19	$20.61, Sept. 12	22.50, Oct. 3	14.08, May 16
1938	2.512c., May 17	2.211c., Oct. 18	23.25, June 21	19.61, July 6	15.00, Nov. 22	11.00, June 7
1937	2.512c., Mar. 9	2.249c., Jan. 4	23.25, Mar. 9	20.25, Feb. 16	21.92, Mar. 30	12.92, Nov. 10
1936	2.249c., Dec. 28	2.016c., Mar. 10	19.73, Nov. 24	18.73, Aug. 11	17.75, Dec. 21	12.67, June 9
1935	2.062c., Oct. 1	2.056c., Jan. 8	18.84, Nov. 5	17.83, May 14	13.42, Dec. 10	10.33, Apr. 29
1934	2.118c., Apr. 24	1.945c., Jan. 2	17.90, May 1	16.90, Jan. 27	13.00, Mar. 13	9.50, Sept. 25
1933	1.953c., Oct. 3	1.792c., May 2	16.90, Dec. 5	13.56, Jan. 3	12.25, Aug. 8	6.75, Jan. 3
1932	1.915c., Sept. 6	1.870c., Mar. 15	14.81, Jan. 5	13.56, Dec. 6	8.50, Jan. 12	6.43, July 5
1931	1.981c., Jan. 13	1.883c., Dec. 29	15.90, Jan. 6	14.79, Dec. 15	11.33, Jan. 6	8.50, Dec. 29
1930	2.192c., Jan. 7	1.962c., Dec. 9	18.21, Jan. 7	15.90, Dec. 16	15.00, Feb. 18	11.25, Dec. 9
1929	2.236c., May 28	2.192c., Oct. 29	18.71, May 14	18.21, Dec. 17	17.58, Jan. 29	14.08, Dec. 3

Based on steel bars, beams, tank plates, wire, rails, black pipe, sheets and hot-rolled strip. These products represent 85 per cent of the United States output.

Based on average for basic iron at Valley furnace and foundry iron at Chicago, Philadelphia, Buffalo, Valley and Southern iron at Cincinnati.

Based on No. 1 heavy melting steel scrap quotations to consumers at Pittsburgh, Philadelphia and Chicago.

Summary of the Week

• Setting up of machinery for priority system brings fresh rush of steel buying . . . October biggest month of year thus far . . . Production rate at 96 per cent . . . Pig iron price advance by one producer to be followed by Washington conferences

ANNOUNCEMENT of a Presidential decree setting up the machinery for a priority system over all private industry and the appointment of a Priorities Board of the National Defense Advisory Commission was immediately followed by a fresh rush of steel orders, particularly from those consumers and distributers who had not hitherto provided ample protection against the future possibility of restricted steel supplies for non-military purposes.

Even though the voluntary system of preferential rating of defense orders has been working satisfactorily in the steel industry and may be continued for some time to come, the growth in the volume of business for national defense and the lengthening of deliveries on many steel products have given rise to greater concern over future supplies among commercial users of steel.

October business has been the largest for any month this year. A few companies have doubled their September volume, while others gained from 15 to 30 per cent. Some companies have thus far in 1940 booked as much business as in all of 1939, not forgetting the heavy ordering in September and October of last year.

It is suspected that a good many buyers are trying to obtain more steel than their prospective requirements call for, and to guard against such over-buying, steel companies are carefully watching all orders. Most of them are not accepting any blanket commitments for the first quarter, insisting upon complete specifications and dates of shipment. It is believed in the industry that if users refrain from panicky buying there will be ample supplies for all consumers, provided delayed deliveries are accepted. The condition which began to manifest itself in the past week will cause confusion and lead to formal priorities sooner than would otherwise be necessary.

Another important development of the week was an advance in pig iron prices announced by the Pittsburgh Coke & Iron Co., applying only to Youngstown and Sharpsville, Pa., and amounting to $1.50 a ton on foundry, malleable and Bessemer grades and $2 on basic grade. Although no other pig iron producer has changed its prices, the action taken was immediately followed by the calling of conferences of producers with the price stabilization division of the National Defense Advisory Commission similar to those held recently in connection with scrap iron and steel.

A shortage of pig iron is apparently developing, but it has not reached a critical stage and may not for some months in view of the stocks in producers' yards. However, there is now a scarcity of low phosphorus pig iron. Some merchant pig iron makers have withdrawn from the market for the time being. Coke and zinc are two other items that are approaching a state of extreme shortage.

NEARLY all major steel-using industries with the exception of oil and can companies are contributing heavily to current buying. With the automobile industry hitting a new production high for 1940 of 117,080 cars and trucks, its consumption of steel is heavy and it has suffered from no shortages. The decision of the industry to use its facilities to a large extent for the production of airplane parts gives rise to some doubts as to maximum motor car output next year, but as airplane parts production will not be started until spring the chances are that motor car output will be continued at full speed until then. In addition to this program two or three manufacturers are now considering production for the Army of an enormous fleet, possible as many as 50,000 of midget combat trucks.

Railroads are buying steadily, but not in heavy volume. The Southern Pacific has ordered 40,000 tons of rails, the Milwaukee 20,000 tons of rails and accessories, while the Missouri Pacific has been authorized to buy 31,750 tons of rails and accessories. The Erie has ordered 1150 cars. An unusual export order is for 150,000 tons of rails for the Iran State Railways.

FABRICATED structural steel lettings are close to 40,000 tons. September orders of 221,991 tons, as reported by the American Institute of Steel Construction, were the largest for any month since April, 1931.

Shell steel represents a large part of prospective defense business. Current inquiries for the U. S. Army total about 450,000 tons, while inquiries for direct and indirect foreign account total more than 225,000 tons.

Ingot production this week is estimated at 96 per cent, up half a point over last week. The steel scrap composite price is unchanged at $20.67 for the third consecutive week. THE IRON AGE capital goods index, rising to 113.1, is at a new high since 1929, but is still well below the peak for that year, which was 130.6 for the week ended July 27.

The Industrial Pace . . .

AS THE RESULT of moderate gains in the steel and automobile series and another substantial rise in the construction component, THE IRON AGE index of capital goods activity advanced to 113.1 in the past week, as compared to 109.8 in the previous period. The past week's figure represents a new 11-year high. Highest point attained by the index in 1929 was 130.6, reached in the week ended July 27.

Advancing to 112.0 from 109.0 in the foregoing week, the automobile component has been exceeded this year only in the first four weeks of January. Assemblies totaled 117,080 units, highest since the week ended Dec. 23, 1939, and comparing with 114,672 in the week previous. Auto output has advanced steadily for 11 weeks from the 11,635 units recorded in the week ended Aug. 10, low point of the current cycle.

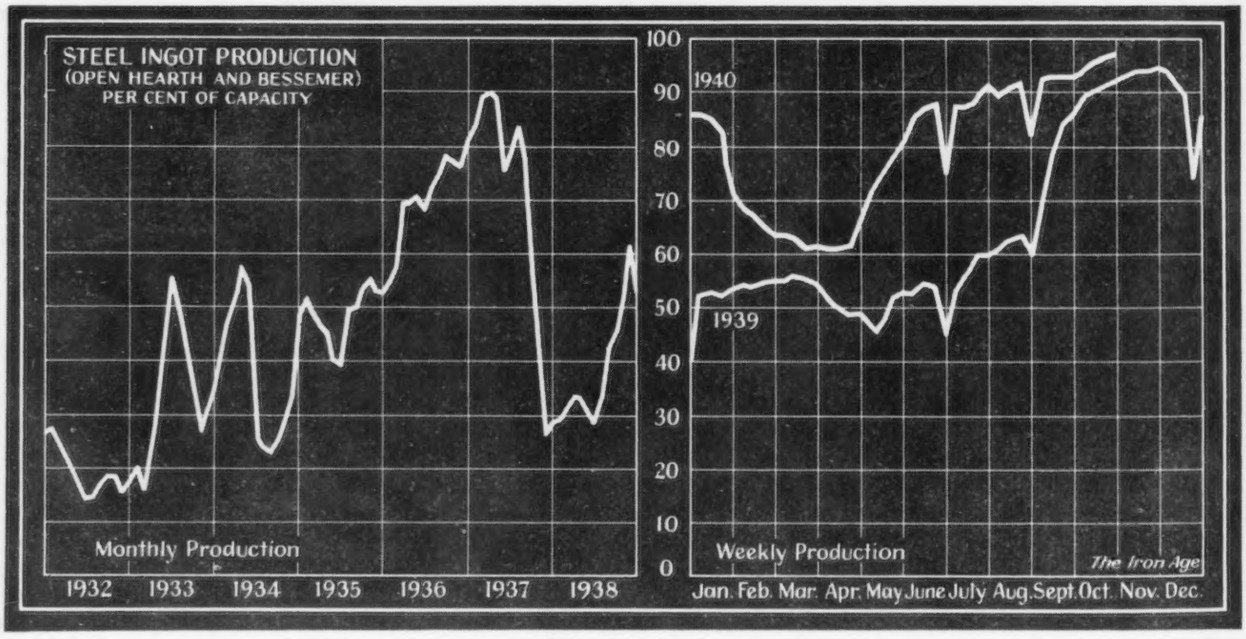
The heavy construction component rose to 128.6 in the past week, as compared with 120.2 in the previous period. Dollar volume of awards placed during the week was $127,317,000, down 47 per cent from the record-breaking volume of the preceding week, but a 98 per cent gain over the corresponding week of 1939. Privately financed construction was off sharply from $66,198,000 to $34,391,000. The value of public projects also dropped, amounting to $92,926,000 in the past week, as compared with $172,595,000 in the previous period. Awards prominent in the week's list included $26,000,000 for a smokeless powder plant at Charlestown, Ind., to be constructed for the government and operated by E. I. duPont de Nemours & Co., $9,000,000 for Army facilities in Iowa, $8,250,000 for temporary housing and a storehouse in Massachusetts, and $7,500,000 for an aircraft manufacturing plant at Seattle, Wash.

THE INDEX OF activity in the Pittsburgh district rose moderately to 111.3 from 109.6 in the previous week, compared with 111.4 a month ago, and 110.3 in the corresponding period last year. A strong upswing in shipments of iron and steel and other river traffic was the principal factor in the gain.

Heavier activity in many diversified fields of industry is reflected in increased railroad freight traffic during October. Carloadings of revenue freight in October, estimated on the basis of figures for the first half of the month, show a moderate increase over those of September, which were 3,135,330 cars, or 783,832 cars a week. October shipments are estimated at 3,235,784, or approximately 808,946 cars a week.

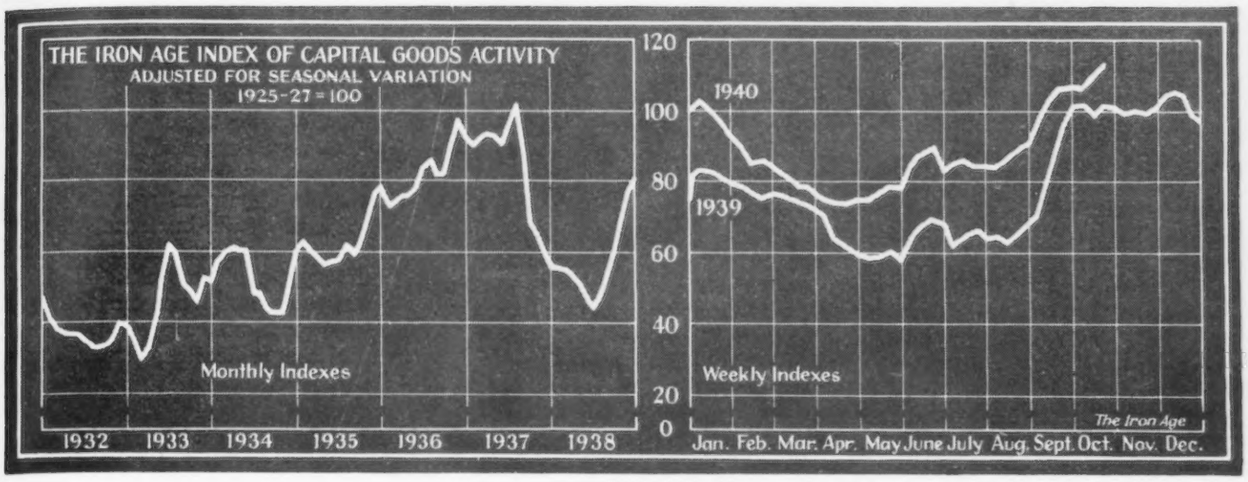
Metal and metal products prices, as measured by the index of the Bureau of Labor Statistics, have risen only 2.5 points since the middle of August, despite substantial expansion in consumer demand. Largest weekly increase occurred in the past week when the index advanced from 96.4 to 97.4. Advancing prices for pig tin and pig lead were chiefly responsible for the rise. In the corresponding period of 1939 the index was 96.3.

Steel Output Gains ½ Point to New All-Time High



District Ingot Production, Per Cent of Capacity	Pitts-burgh	Chicago	Valleys	Phila-delphia	Cleve-land	Buffalo	Wheel-ing	Detroit	Southern	S. Ohio River	West-ern	St. Louis	East-ern	Aggre-gate
Current Week . .	95.0	98.0	95.0	94.0	87.0	108.5	104.0	100.0	109.0	109.0	69.0	100.0	80.0	**96.0**
Previous Week . .	94.0	98.0	94.0	94.0	87.0	104.5	104.0	100.0	105.0	109.0	72.0	96.5	80.0	**95.5**

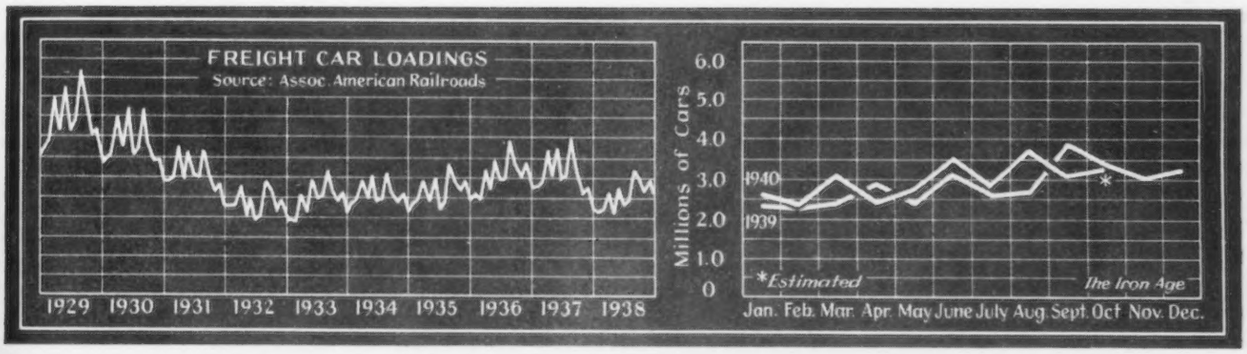
Moderate Increase Shown by Capital Goods Index



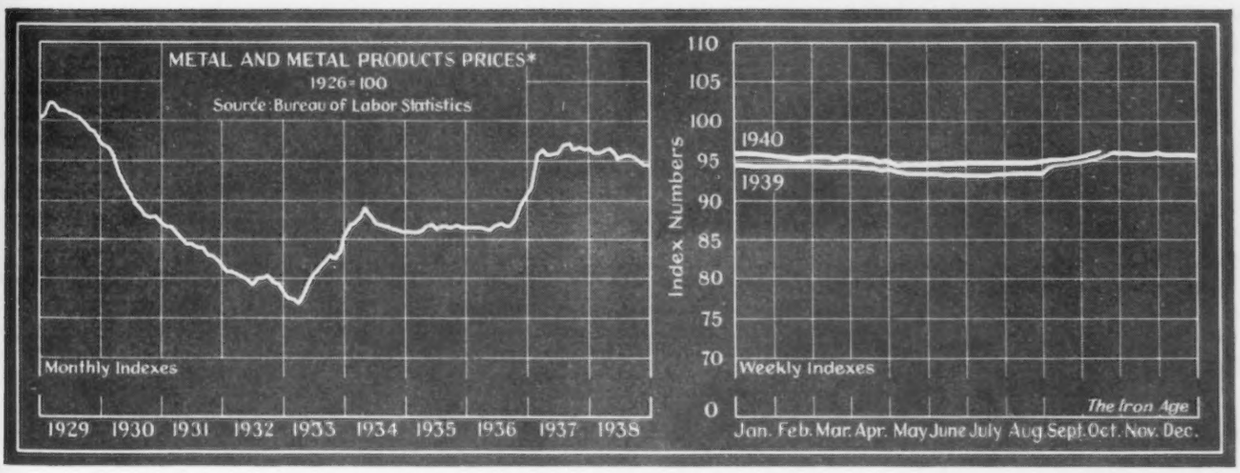
▼ Component Week Ended ►	Oct. 26	Oct. 19	Sept. 28	Oct. 28 1939	Oct. 26 1929
Steel ingot production[1]	138.2	135.9	133.5	132.2	114.2
Automobile production[2]	112.0	109.0	108.9	113.8	122.0
Construction contracts[3]	128.6	120.2	106.5	77.4	105.1
Forest products carloadings[4]	75.4	74.5	73.3	71.4	117.7
Pittsburgh output and shipments[5]	111.3	109.6	111.4	110.3	116.5
COMBINED INDEX	113.1	109.8	106.7	101.0	115.1

Sources: [1] THE IRON AGE; [2] Wards Automotive Reports; [3] *Engineering News-Record;* [4] Association of American Railroads; [5] University of Pittsburgh. Indexes of forest products carloadings and activity in Pittsburgh area reflect conditions as of week ended Oct. 19. Other indexes cover week of Oct. 26.

Weekly Freight Movement in October Expands



Little Change Shown By October Metal Products Prices



* Based on 147 items, including iron and steel, non-ferrous metals and finished products as agricultural equipment, automobiles, tools, bolts, etc.

Market News

. . . THE WEEK'S ACTIVITIES IN IRON AND STEEL

New Business

. . . Fear of priorities causes further rush of buying

Despite assurances from Washington that priorities will be handled in a judicious manner and that voluntary action will be the only kind taken unless conditions get out of hand, many consumers are belatedly realizing their possible plight over the next few months in view of their relatively small inventories and the pickup in their own operations.

The talk of impending priorities makes little sense so far as the steel industry is concerned when it is realized that for some time direct and indirect national defense projects have been given the green light. Under this latter arrangement, experienced steel men, without formal restrictions, have been able to produce, allocate, and ship steel tonnages where the greatest need for them exists. It is believed that any formal priority system which might be instituted by those unfamiliar with the great number of production and delivery problems in the steel industry would serve only to hamstring the present constructive efforts.

Within the past week or two PITTSBURGH mills have noticed a rush of orders from miscellaneous consumers who fear their inability to obtain sufficient stocks in coming months and are therefor ordering more than necessary for their own consumption in order to slowly build up protective inventories. Total bookings at PITTSBURGH so far this month are running from 15 to 30 per cent ahead of a month ago and bookings continue to be in excess of both shipments and production.

October closed well ahead of September at CHICAGO in both new business and shipments. Some steel makers reported the month's volume to be twice as much as that recorded for the preceding period. Orders are running ahead of shipments, backlogs are rising steadily —in some cases sharply—and inventory buying has become more pronounced. The number of customers, particularly those not handling defense business, seeking reservation on future schedules is increasing. Even the busiest plants are getting all the steel they can use at the present time. With the industry's practice of exercising voluntary priorities on defense business, little reason is seen at CHICAGO for any other preference forms to be invoked. Capacity is ample to care for steel needs if orderly buying is maintained and defense work is and has been pushed ahead by steel makers' own volition.

Bars and structural shapes continue at an intense pace in CHICAGO with deliveries on the latter extending steadily.

Demand for steel continues its general upward progression at CLEVELAND and YOUNGSTOWN. Led by requirements of the construction industry and alloy steel users, October is closing with activity at a vigorous pitch. Aggregate sales may prove to be best of any month in years.

In electric furnace alloy steel, which has been in great demand during the past year, it is now virtually impossible to obtain definite delivery promises from one or two Ohio producers.

CLEVELAND reports October pig iron shipments hold every promise of being highest for any month in years.

At BIRMINGHAM the greatest volume of steel in the history of the district is booked, enough to assure steady production indefinitely.

Government order for forging and machining 6-in. shells, estimated to call for 75,000 tons of steel, and a 15,000-ton rail order by Southern Pacific highlights new business in that district.

Orders growing out of the national preparedness program are just beginning to be felt there but preparedness projects already announced, such as the munitions plant at Gadsden and an ammunition storage depot near Anniston, are expected to add to the large demand for steel.

In NEW YORK and PHILADELPHIA there has been a rush to buy following announcement in Washington of a priority set-up to be used when necessary. Mills are carefully policing customers' orders in an effort to prevent overbuying. A good deal of the business placed in the past week was for first quarter delivery, and in such instances mills are not accepting blanket coverages, but are insisting on definite specifications and shipping dates.

Pig Iron

. . . Price advance by one producer results in calling of Washington conferences

Pittsburgh Coke & Iron Co. on Oct. 25 announced an increase of $1.50 a ton on foundry, malleable, and bessemer pig iron and $2 a ton on basic iron at Sharpsville, Pa., and Youngstown. Higher raw material costs were said to be the reason for the increase which was effective on announcement. No change was made on the price of pig iron at the company's Neville Island, Pa., furnace as it was stated they had "nothing to sell," all productive capacity and supplies apparently having been earmarked by orders and contracts. Up to Tuesday of this week other pig iron producers had made no move to meet the price increase at Sharpsville and Youngstown.

Immediately following the announcement by Pittsburgh Coke & Iron Co., the price division of the National Defense Advisory Commission, headed by Leon Henderson, announced that a series of informal conferences with pig iron producers would be held. Mr. Henderson stated that in response to a "number of inquiries," the price stabilization division would survey pig iron producing costs, prices and inventories in conjunction with the recent review of the scrap situation.

Without reflecting any particular concern over the reported price increase, Mr. Henderson told THE IRON AGE that his division is watching "all elements" having a tendency for "tilting" prices upward.

Unlike the two conferences at-

tended in recent weeks by representatives of distributers and suppliers of scrap iron and steel, merchant pig iron producers will not convene in Washington at the same time. Defense commission officials declined to make public the names of companies invited to the informal conferences or the dates on which they would meet in Washington, although it was indicated that representatives of the Pittsburgh Coke & Iron Co. are expected to attend.

Although no other pig iron producers have followed the lead of the Pittsburgh Coke & Iron Co. in advancing prices, there were some repercussions in the trade. A few producers withdrew from the market for sales over the remainder of the year, a situation, however, that would probably have been forced on them anyway because of their sold-up condition.

The approaching shortage of pig iron, which may not, however, prove to be serious before next spring, is indicated by the deal recently arranged between the Bethlehem Steel Co. and the National Steel Corp. whereby the former is taking hot iron from the latter's Hanna stacks at Buffalo. It is understood that an idle Hanna furnace at Buffalo may be repaired and put into blast to take care of Bethlehem's requirements, but the furnace probably will not be ready for operation before the early part of next year.

The wear and tear on furnace equipment by continued heavy production will bring about some temporary shutdowns. One has occurred at Birmingham, where Sloss-Sheffield has taken off its No. 3 furnace for repairs, which will take 15 or 20 days. This is the first time in many months that pig iron production in the Birmingham district has fallen below capacity. The Perry merchant furnace at Erie, Pa., has gone into blast with a large order book.

Shipments are now a better gage of pig iron consumption than sales because of the inability of some producers to make further commitments for the next few months. In some instances shipments are in excess of merchant production, the difference being made up by shipments from furnace stocks, which are slowly dwindling.

Steel Operations

. . . Industry rate moves up another notch to 96 per cent

With greater employment of bessemer steel making capacity, the rate of ingot production this week has gained to 96 per cent from 95½ per cent last week, and indications point to further rises.

Only in the WESTERN district, which embraces mills from Colorado to California, has the industry failed to attain almost maximum production. That district has declined three points to 69 per cent. There have been gains in the PITTSBURGH, YOUNGSTOWN, BUFFALO, BIRMINGHAM and ST. LOUIS districts.

Several districts are now about above 100 per cent of rated capacity, such rated capacity making a 12½ per cent allowance for inevitable shutdowns for repairs. These districts and their current rates are: BIRMINGHAM and SOUTHERN OHIO, both at 109; BUFFALO, 108½; WHEELING-WEIRTON, 104. The DETROIT and ST. LOUIS districts are at 100 per cent.

Merchant Bars

. . . Heavier buying caused by fear of priorities

Engendered by fears of priorities, either formal or otherwise, miscellaneous consumers have bought more heavily at PITTSBURGH. Deliveries have become more extended. Analysis of order books discloses a wide diversification in consumer outlets. Some steel consumers, belatedly realizing that government orders have been given priority over commercial business for the past several weeks, have become apprehensive concerning their inventory position, and are ordering accordingly. Demand for bar stock used in shell making is increasing steadily. PITTSBURGH reports jobber buying has improved substantially within the past two weeks.

Both carbon and alloy bars continue to hold the lead in activity at CHICAGO. Most mills are booked through the end of the year and, because of widespread demand, buyers are getting their future needs outlined. One producer now quotes 10 to 12 weeks on rounds and eight to 10 weeks on bar mill shapes. October business in steel bars was far ahead of that for September as well as any other month in the year.

Carbon, alloy and cold finished bar sales at CLEVELAND and YOUNGSTOWN continue to gain momentum under the impetus of the defense program. Pressure for deliveries is increasing and producers are bringing in more marginal equipment to help alleviate the situation.

Semi-Finished Steel

. . . Sales held in check by "sold out" position of mills

Still held in check by available capacity, semi-finished steel sales in the past week expanded moderately but such increases are meaningless owing to the "sold out" position of this particular market. Large integrated mills are experiencing difficulty in allocating proper semi-finished tonnages to various finishing departments and at the same time fulfilling national defense and non-integrated mill obligations. The big push, however, is yet to come as large volume buying of munition steel for the U. S. Government is expected to materialize later this year, although such tonnage has been on the increase recently.

Production continues high on all items at CLEVELAND and YOUNGSTOWN, where sales of forging billets and rods have been particularly heavy during the past week. October closed well ahead of the preceding month in total semi-finished steel business at CHICAGO. Semi-finished steel is among the most active items in that district.

Sheets and Strip

. . . Orders are increasing and deliveries are lengthening

PITTSBURGH **reports** substantial increases in the volume of sheet and strip specifications over the comparable September period. Activity has also heightened in the past week as the fear of priorities drives in those consumers who feel their stocks are at too low a point for comfort. Automotive purchases have been flowing in steadily at PITTSBURGH so that it can be said that the automobile industry is buying continuously rather than concentrating its purchases at any one time. Other major consumers are

getting on order books with the result that sheet promises are becoming further extended, although not to the extent noted in some other steel products. With many sheet mills throughout the country being allocated raw steel supplies in accordance with the general demand picture, total sheet capacity is of secondary importance.

Aggregate orders at CLEVELAND and YOUNGSTOWN show a favorable gain over September. Specifications from the automotive industry have been generous during the past week. Large tonnages have been received recently from manufacturers of steel shop and office equipment for extended shipment.

Pronounced activity by household utility manufacturers such as ranges, refrigerators, etc., has helped build up sheet backlogs at CHICAGO. Auto parts makers are also providing a sizable market. One mill has extended deliveries on sheets, 2½ in. to 8 in., up to four to five weeks.

Sheet demand has been consistently at about full capacity in the SOUTHERN OHIO district for the past six weeks. The unusually good demand for galvanized material has just about filled rolling schedules and has dropped over into a small backlog. Virtually all of the present demand is from domestic sources, foreign business being almost negligible.

Reinforcing Bars

. . . Awards total 8950 tons, inquiries 4950 tons

Reinforcing bars remain generally firm, although some soft spots have appeared throughout the country. Such random weaknesses, however, are far less important than the concessions that were common a few months ago. It is understood that the number of jobs placed recently involving less than 100 tons add up to a substantial total.

Reinforcing steel awards of 8950 tons include 2325 tons for the John Martin Dam (Caddoa Dam) at Caddoa, Col., 1340 tons at Hawthorne, Nev., for the Navy ammunition depot, and 1000 tons at Oakland, Cal., for the Peralta Villa housing project.

New reinforcing steel projects call for 4950 tons. The only sizable inquiry is 2500 tons for a housing project at Hartford, Conn.

Structural Awards Highest In 9 Years

• • • New orders for fabricated structural steel booked during September were the largest for any month since April, 1931, according to reports received by the American Institute of Steel Construction. The industry booked a total of 221,991 tons that month, as compared with 121,357 tons for the same month last year. The increased tonnage booked in September brought the new business during the first nine months this year to a total of 1,143,314 tons, or an increase of 14 per cent over the bookings for the first nine months of 1939.

The shipments for September totaled 132,773 tons and were larger than any month during the present year. The tonnage available for future fabrication has now reached the total of 511,455.

Plates

. . . Some tonnage being booked for first quarter

With deliveries becoming even more extended, some PITTSBURGH plate producers on certain sizes at least have found it necessary to book tonnage at the price at time of shipment. The making of light gage plates on high speed mills is hampered to some extent by the congestion attendant on maximum production schedules at such mills.

Requirements of the construction field continue as the most prominent in the plate market at CLEVELAND but other consumers are well represented on incoming tonnage. While the biggest demand for armor plate is still in the future, shipments are heavy, indicating some fabricators are storing material for later usage.

Heavy demand at CHICAGO for wide plates from machinery and oil tank builders, augmented by brisk calls from various other sources, is extending plate deliveries in practically all sizes. However, one mill which has extended promises on wide plates, can easily handle orders for sizes under 84 in.

Despite the fact that most producers are booked solidly through December, and except for certain sizes it is impossible to obtain delivery of material this year, there is an active interest in plates in the New York area. The demand reflects a very diversified demand and defense program needs are gradually assuming an important position. In some instances orders have been taken for first quarter shipments at prices in effect at that time, but there is a general desire to avoid future commitments until prices have been announced.

Export demand is moderately active and some business has been booked at the new price of 2.35c. per lb., f.a.s. Some export tonnage has also been accepted for first quarter delivery at 2.35c.

Railroad Buying

. . . Southern Pacific orders 40,000 tons of rails, Erie 1150 cars

Chief activity in the railroad market in the past week was the purchase of 40,000 tons of rails by the Southern Pacific and awarding of 1150 freight cars by the Erie.

The rail purchase by Southern Pacific was allocated as follows: 15,300 tons to U. S. Steel Corp.; 12,200 tons to Colorado Fuel & Iron Corp., and 12,500 tons to Bethlehem Steel Co. It is understood that the Southern Pacific has not yet had full delivery on purchases made last year for its Texas lines and hence may not be in the market for that territory this year.

Chicago, Milwaukee, St. Paul & Pacific has placed an order for 20,000 tons of 131-lb. and 112-lb. rails and fastenings, divided about equally between Carnegie Illinois Steel Corp. and Inland Steel Co. Missouri Pacific has received court authorization to purchase 31,750 tons of rails and accessories.

Although a considerable tonnage of rails has not yet reached the formal placement stage, it is known that mills have been approached as to probable tonnages to be ordered later. Iran State Railways are understood to have purchased between 150,000 and 160,000 tons of rails and accessories in this country within the past 10 days.

The Erie purchase of 1150 cars was divided as follows: 250 hopper cars to Pullman Standard Car Mfg. Co., 250 hopper cars to General American Car Co., 250 mill-type gondolas to Greenville Steel Car Co., 200 box and 100 furniture cars to American Car & Foundry Co. and 100 box cars to Magor Car Co. War Department has awarded 260

10,000 gal. gasoline tank cars to American Car & Foundry Co. Illinois Central has ordered four diesel-electric locomotives from Electro-Motive Corp.

Only new inquiry of size is that of the Lehigh & New England for 300 hopper cars.

The Baltimore & Ohio has applied to the ICC for issuance of $4,750,000 in equipment trust certificates, the proceeds of which would be used to pay 80 per cent of the cost of $5,969,250 worth of new equipment recently ordered.

Wire Products

. . . Production held in check only by raw steel supply

Held in check only by the ability of wire mills to obtain allotments of available raw steel, production of wire and wire products at PITTSBURGH remains at a high level. Total demand is as strong as ever with deliveries becoming somewhat extended on manufacturers' wire and with wire rods in some instances sold out for the remainder of the year. The probability that government priorities, either formal or otherwise, might interfere with the steady flow of material to commercial consumers, has filtered down to those customers who so far have not seen fit to make forward commitments or build up inventories and they are attempting to make up for lost time.

Shipbuilding

. . . 10 seaplane tenders and two cargo ships awarded

The Navy Department last week awarded contracts aggregating $45,241,996 for the construction of 10 small seaplane tenders, six going to the Lake Washington Shipyards, Seattle, at $4,510,000 each, and four to the Associated Shipbuilders, Seattle, at $4,545,499 each. They will require about 5500 tons of plain plates, shapes and bars.

The Maritime Commission has awarded a $3,980,000 contract to the Seattle-Tacoma Shipbuilding Corp., Tacoma, Wash., for the construction of two C-3 vessels to be converted into Army transports. These ships will require a total of 8740 tons of steel.

Coke

. . . Supplies tighter, but no sign yet of critical shortage

Beehive coke circles insist that supplies are becoming tighter but as yet there is no sign of a critical shortage. Prices on standard furnace coke remain unchanged at $4.50 to $4.75, f.o.b. Connellsville, with slightly higher prices being obtained on small spot sales. However, it is expected that when first quarter contracts are made the new prices may be $5 or more a ton. It is noted in passing, however, that when coke is urgently needed supplies are often dug up from some place as was demonstrated these past few weeks when Perry blast furnace at Erie, Pa., was blown in after having been able to obtain coke supplies from the Connellsville region. It is believed that some large users of coke for blast furnace activity are adding to their stocks in preparation for seasonal holdups in transportation and coke production which generally materialize with the advent of cold weather. At the rate loose beehive supplies are being picked up, it is believed that little free material will be available after the first of the year.

Bolts, Nuts and Rivets

. . . October orders 20% ahead of September

At CLEVELAND bolt and nut producers report October orders are ahead of the September volume by roughly 20 per cent. Depending on the item desired, delivery promises at CLEVELAND range from two to four weeks on standard sizes and up to six weeks on some specialized items. Producers report their stocks have been lowered considerably in the last two months.

Tin Plate

. . . Operations are unchanged
. . . Forward buying being done

Can companies are still going along with steel mills by placing anticipated needs with tin plate mills. Hence operations are unchanged this week at 46 per cent and cold reduced tin plate operations remain at around 70 per cent. No marked change in the present situation is looked for in the near future. Some buyers are making reservations through first quarter, and in some instances through nine months of 1941.

Tubular Goods

. . . Building activity aids merchant pipe sales

Mechanical and boiler tubing sales are still expanding at PITTSRURGH while oil-country goods requirements are substantially unchanged from a week ago. Line pipe demand has subsided but building activity, both private and governmental, continues to exert a tremendous influence on the flow of standard pipe specifications to the mills.

Structural Steel

. . . Dangers of official priority system are seen

Production problems galore are being faced by structural mill operating men as Pittsburgh mills attempt to satisfy everybody, including those with and without government contracts. Meanwhile, promises on structural shapes and plates are even more extended than a week ago and matters are not being helped any by the sudden appearance of government-sponsored jobs about which little or nothing was known theretofore.

Any attempt at formal or official priorities on structural steel products would probably result in chaos. With the steel mills already giving government jobs priority over commercial projects and with experienced steel executives scheduling mill operations so that the greatest number of consumers are taken care of in the best possible manner, a change in this method would probably cause uncalled for delay and confusion.

Fabricated structural steel lettings are slightly higher at 39,925 tons against 39,050 tons last week. The Curtiss-Wright Corp. awarded contracts for three plants totaling 24,340 tons, located at Cheektowaga, N. Y.; Columbus, Ohio, and St. Louis. Other sizable awards include 2000 tons at Brooklyn, for Atlantic Avenue improvements; 1900 tons at Jamaica, Long Island, for the Metropolitan Jockey Club grandstand, and 1100 tons for an apartment house in New York at 37th Street and Madison Avenue.

Machine Tools

. . . SALES, INQUIRIES AND MARKET NEWS

Die Shops to Get Aero Work

Detroit

• • • **Tool and die work** in large volume will be the principal outcome of the plan of the National Defense Advisory Commission to make use of automotive production facilities to manufacture metal parts for airplanes. Contracts, however, will not be placed until spring, so automotive tool and die work can proceed meanwhile for 1942 models. The program, outlined following the Automobile Manufacturers Association resolution to subordinate automotive requirements to defense needs, makes provision for the use of available machine tools and other equipment for stampings and machine forgings. This is a definite effort to avoid further overloading the machine tool industry at a time when delivery dates are so extended that the current major projects at Ford, Packard, Chrysler and General Motors are being forced to wait for delivery of equipment.

Delivery Problems Complicated

Cincinnati

• • • **Each working day** adds to the problems of machine tool builders in this area, as fresh business continues to complicate production and delivery problems. Virtually every manufacturer in the area is well sold far into next year, although on some types of standard machines fairly prompt deliveries are possible. With this continual mounting of orders in the face of pressure for early delivery, priorities have been difficult of maintenance. In fact, there is some feeling among the manufacturers that the tension will have to continue until the government can definitely define equitable priority schedules. Plants are using every nook and cranny of floor space to swell production, while at the same time pressing learner and apprentice training schedules to equip sufficient skilled labor to handle the situation. On the current week's business, the whole list of tools is represented, with milling machines, grinders, lathes, boring mills and planers still most strong.

Another Active Week

Cleveland

• • • **The past week** has been very active here. Considerable new business has been breaking, the result of gradual spreading of the government defense program. The lower Michigan territory has been exceptionally fruitful. More orders have come through from Packard, including large turning equipment, while additional equipment has been bought by A. C. Spark Plug, Saginaw Steering Gear and other companies engaged in the defense program.

Attempts are being made to reclassify preference ratings. As the situation stood a few weeks ago, it was impossible for machine tool builders to differentiate as to the most vital business. At least two important plants in this city only had A-2 ratings, one of them being an important producer of marine engines. Another case of interest was a gun mount manufacturer and a maker of road building equipment being given the same classification for preference.

This immediate territory abounds with plant enlargement projects. Announcement of two of the biggest expansions is being withheld pending approval of government financing.

Order Volume Holds

New York

• • • **There has been** no diminution in the volume of inquiries and orders in this district in the past week. Aircraft engine and parts makers continue to dominate the picture even though one $20,000,000 machinery buying program is about completed except for the issuance of formal orders in many instances. As far as ordnance work is concerned, there are few new faces in the picture. Several railroad equipment manufacturers are still actively in the market, as is one large electrical equipment maker. Shipyards have lists out for large tools.

Deliveries are still the main problem here as elsewhere. Leading suppliers report losing business to secondary lines, and some marginal producers are beginning to become a factor. They are able to quote quite prompt deliveries. Standard machines are being quoted into next June and July. Many important tools are not available for a year to a year and a half. With the tremendous pressure for delivery on the part of all defense contractors, dealers are urging their customers to get preference classifications assigned to existing contracts or subcontracts against which they have ordered machine tools. Under the present voluntary priorities system, this classification, assigned by the Army and Navy Munitions Board, Room 2010, Munitions Building, Washington, gives the dealer and his principal some clue as to the urgency of the request for early delivery. So many projects have recently been given A1 classification that this group will be broken down into six subdivisions, beginning with A1-A and ending with A1-F.

Heil Co. to Enlarge Its Main Plant

Milwaukee

• • • **The Heil Co.** has outgrown its main plant at 3000 W. Montana Avenue because of large government contracts for trailers, truck bodies, etc., and will immediately enlarge its production facilities by taking an option with a view to later purchase of the group of buildings at 445 W. Oklahoma Avenue, formerly occupied by the Beaver Mfg. Co. The Beaver properties include about 16 acres and four buildings with a floor space of 200,000 sq. ft. and the transaction involves more than $100,000. The move will mean the employment of several hundred more men. The main plant now has about 1000 workers.

Non-Ferrous Metals

. . . MARKET ACTIVITIES AND PRICE TRENDS

New York, Oct. 29—All nonferrous markets, with the exception of tin, saw considerable activity in the past week. The lead market for the second successive week appeared to be most active, with sellers on several occasions being forced to hold customers off a day. Seeming quietness in the zinc market was belied by substantial sales figures appearing today. Rationing to a greater or lesser degree is still in force in the latter two markets, as well as in copper.

Premiums asked by custom smelters earlier in the week, which made the price of electrolytic copper 13c. for prompt delivery and 12.75c. for shipment in the first quarter of next year, gradually declined during the period and today were down to 12.50c. and 12.25c., respectively. Mine producers continue to hold strictly to 12c. a lb., delivered Connecticut Valley. Inquiries are still larger than these sellers care to take, and some sort of distributing policy is necessary. Fluctuating activity in the export market at the 10.50c., f.a.s., level was in evidence.

Tin

Buying interest declined steadily during the past week and the present week opened on a stagnant market. Prices for prompt Straits metal declined from 51.675c. to 51.50c. a lb. delivered New York, without consumer reaction. Quotations on November arrivals center around 51.25c. and those for December at 50.75c. Recent arrival of steamers carrying 3375 tons of tin bring total imports for the month to 9000 tons, about 3000 tons in excess of current consumption.

Zinc

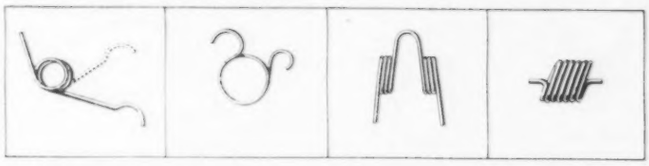
After appearing outwardly quiet and unchanged throughout the past week, activity in the market received a different aspect when sales figures for the period were made available. Sales of prime Western during the week attained the sizable volume of 10,120 tons, comparing with 4000 tons in the previous week and 9200 tons three weeks ago. Shipments were down to 4585 tons from 6665 tons in the foregoing period. Supplies had become no less tight and both buying and selling interests appeared to have temporarily eased the given most of their attention to the facilitating of shipments. Prices are strong at 7.64c. per lb. delivered New York.

Lead

Characterized by considerably more moderate figures than those previously estimated by the trade, statistics released in the past week revealed that refined lead stocks declined only about 2000 tons to 41,300 tons during September. In spite of the comparatively small drop, the figure constituted a long-time low, comparing with 97,473 tons in September, 1939. Total shipments during the period, although estimated earlier at as high as 55,000 tons, were 53,456 tons, comparing with 51,643 tons in August and 59,889 tons in September of last year. Buying during the past week was again very brisk and supplies in some cases not entirely adequate. As in the previous week, sellers were forced to carry some business over a day. There was a slight tapering off at the end of the week but when sellers opened December books on Monday, buyers entered the market in numbers. November is now about 85 per cent sold, while December is 25 per cent accounted for. An ample cushion for the market is provided by large supplies of foreign lead, considerable tonnages of which are now coming into the market from Mexico, Australia and Peru.

the practical side of Springmaking—BY DUNBAR

Some tips on TORSION SPRINGS



* They should be free on rod or post—when under full load.
* The action should tend to reduce or wind the coils.
* Sharp bends should be eliminated.
* Material should be selected for individual conditions of temperature, corrosion or stress.
* Ends should be designed for easy assembly.

WE RECOMMEND

that you send us your assembly. We may be able to anchor one arm to it—or change the contour to save on assembly time.

Dunbar Bros. Co.

DIVISION OF ASSOCIATED SPRING CORPORATION

BRISTOL, CONNECTICUT

"Quality Springs Since 1845"

Scrap . . . MARKET ACTIVITIES AND QUOTATION TRENDS

For the third consecutive week, THE IRON AGE scrap composite is unchanged at $20.67. While apparently the primary factor in restraining the upward movement of the market has been the intervention of the National Advisory Defense Commission, there are other factors currently present which are tending to subdue any possible bullishness. In the East, a lull in export loadings for Great Britain, coupled with the cessation of Japanese shipments, has greatly reduced the volume of buying for export account. The slackening in British shipments, however, is expected to be only temporary and a renewal of activity at a pace at least equal to that of September is expected soon. In other districts, the unusually high ratio of pig to scrap being used by a number of plants has resulted in a noticeable reduction in scrap requirements. The heavy flow of production scrap to steel mills is also a factor in the Pittsburgh area. Price changes this week are largely in secondary grades and are mostly upward, although some changes downward have been made. Efforts to increase domestic scrap supplies in Great Britain has resulted in the collection of 22,000 tons of wrought and cast iron scrap since last May. This tonnage reflects only the scrap "railing" phase of the effort.

Pittsburgh

Although the market undertone continues strong, activity is at a minimum. Appraisal of market conditions involving broker and consumer sales still indicates that No. 1 heavy melting remains quotable at $21 to $22, unchanged from last week. Railroad specialties are slightly weaker. Lack of transactions involving open market scrap and the steady flow of production scrap to steel mills is responsible for the more or less stabilized position of the market.

Chicago

A static market continues here with prices on the entire list unchanged for the third consecutive week. With steel mills generally possessing comfortable inventories, little trading is taking place.

Philadelphia

Apparently to the satisfaction of both buying and selling interests in the district, the market remains steady at quoted levels. Sales have been in moderate volume at the range of $20.50 to $21 for No. 1 steel. Supplies at current levels are adequate, brokers reporting no difficulty in getting material and shipments are moving freely.

Youngstown

The situation here is very much the same as the start of this week as noted in the last report. Restricted schedules on shipments prevail at Warren and Youngstown, and new mill purchases are rare. Prices remain nominal and unchanged.

Cleveland

Buyers and dealers are watching the pig iron situation closely here. The high ratio of pig iron being melted in recent weeks has cut into scrap shipments, which are low considering the rate of production. Published prices are unchanged this week.

Buffalo

There has been no mill buying here and prices are unchanged this week, despite reports of small sales of No. 1 heavy melting within the $20.50 to $21 range. Dealers are said to have turned down a $20 bid from the area's largest consumer for No. 1 steel.

St. Louis

Prices here are mostly unchanged, but No. 1 heavy melting is up 50c. on covering by dealers to meet current orders. A few specialties are 50c. higher. Shipments are being received here from Louisiana and Texas points which heretofore were exported, and there are other offerings which tend to put a brake on a rising market.

Birmingham

Scrap is moving at a steady pace here and shipments are being made as soon as stocks arrive on dealers' yards. Foundries are using heavy amounts of cast grades. Following embargo on shipments to Japan, inquiries from export dealers for domestic shipments are more plentiful.

Cincinnati

With mill interest in further purchases of old materials abating, dealers have held prices to present levels. The mixed complexion of the national market tends to make dealers in this area more conservative. Currently, some material on contract is moving and foundry grades are reported to be active.

Detroit

Maximum output of scrap is being reached by plants in this area, causing some downward movement in prices since some consumers have held up shipment. While the readjustment is in process the market is somewhat quiet.

New York

Prices on prime melting steel are unchanged this week, but several minor adjustments have been made to secondary grades. Export movement has slowed down considerably in recent weeks and this has acted to subdue any bullishness which might arise out of the high rate of shipments to domestic consumers. Following on the heels of the Japanese embargo has been a pronounced lull in scrap movement to Great Britain. Shipments to Great Britain in October fell far below even the September rate, but a sharp upturn is expected shortly.

Boston

American Steel & Wire Co. is buying No. 1 and 2 steel. Brokers and dealers supplying this material are selling No. 1 on a basis of $17 delivered, and No. 2 at $15.50, equivalent to the export basis. A New England consumer is paying $8.25 delivered for blast furnace material, while for eastern Pennsylvania consumption brokers pay $15.50 on cars for breakable cast, $9.25 to $9.50 for steel turnings, $12 for bundled skeleton, and $19.50 to $19.65 for shafting. Otherwise little, if any, scrap is moving. The export market is at a standstill temporarily because of a lack of boats.

Toronto

Brisk activity continues the dominating feature of the market here. Price sentiment also is improving and local dealers have advanced buying price on No. 2 heavy melting 25c. to $10, delivered yards. Other items are firm. During the 10 days offerings to dealers increased and many yards are jammed with difficulties in handling. Deliveries from northern Ontario are slowing down and it is expected shipments from this source will be of minor proportion until next Spring. Despite greater inflow of scrap into dealers' yards, there is no piling up of inventories as consumers' demands continue well above supply and shipments to various consuming points are being made as rapidly as dealers can sort and load cars.

PITTSBURGH

Per gross ton delivered to consumer:

No. 1 hvy. mltng. steel	$21.00 to $22.00
Railroad heavy mltng.	22.50 to 23.00
No. 2 heavy melting	19.50 to 20.50
Railroad scrap rails	23.00 to 23.50
Rails 2 ft. and under	26.50 to 27.00
Comp. sheet steel	21.00 to 22.00
Hand bundled sheets	20.00 to 21.00
Heavy steel axle turn.	20.75 to 21.25
Heavy steel forge turn	19.75 to 20.25
Machine shop turnings	15.50 to 16.00
Short shov. turnings	17.00 to 17.50
Mixed bor. & turn.	14.00 to 15.00
Cast iron borings	14.50 to 15.00
Cast iron carwheels	22.50 to 23.50
Heavy breakable cast.	17.00 to 17.50
No. 1 cupola cast	22.00 to 22.50
RR. knuckles & coup.	27.50 to 28.00
Rail coil springs	27.50 to 28.00
Rail leaf springs	27.50 to 28.00
Rolled steel wheels	27.50 to 28.00
Low phos. billet crops	27.00 to 27.50
Low phos. punchings	27.00 to 27.50
Low phos. heavy plate	25.00 to 26.00
Railroad malleable	24.50 to 25.00

PHILADELPHIA

Per gross ton delivered to consumer:

No. 1 hvy. mltng. steel	$20.50 to $21.00
No. 2 hvy. mltng. steel	19.50 to 20.00
Hydraulic bund., new	20.50 to 21.00
Hydraulic bund., old	17.50 to 18.00
Steel rails for rolling	25.00 to 26.00
Cast iron carwheels	22.50 to 23.00
Hvy. breakable cast.	21.00 to 21.50
No. 1 cupola cast	22.50 to 23.00
Mixed yard (f'd'y) cast	.... 19.50
Stove plate (steel wks.)	.... 18.00
Railroad malleable	22.50 to 23.00
Machine shop turn.	14.50 to 15.00
No. 1 blast furnace	13.00 to 13.50
Cast borings	14.50 to 15.00
Heavy axle turnings	19.00 to 19.50
No. 1 low phos. hvy.	25.50 to 26.00
Couplers & knuckles	25.50 to 26.00
Rolled steel wheels	25.50 to 26.00
Steel axles	25.00 to 25.50
Shafting	25.00 to 25.50
Spec. iron & steel pipe	18.00 to 18.50
Cast borings (chem.)	.... 15.00

CHICAGO

Delivered to Chicago district consumers:

	Per Gross Ton
Hvy mltng. steel	$19.50 to $20.00
Auto. hvy. mltng. steel alloy free	18.50 to 19.00
No. 2 auto steel	16.25 to 16.75
Shoveling steel	19.50 to 20.00
Factory bundles	19.00 to 19.50
Dealers' bundles	17.50 to 18.00
No. 1 busheling	18.50 to 19.00
No. 2 busheling, old	11.50 to 12.00
Rolled carwheels	23.25 to 23.75
Railroad tires, cut	23.00 to 23.50
Railroad leaf springs	23.00 to 23.50
Steel coup. & knuckles	23.00 to 23.50
Axle turnings	18.75 to 19.25
Coil springs	24.00 to 24.50
Axle turn. (elec.)	19.75 to 20.00
Low phos. punchings	22.50 to 23.00
Low phos. plates 12 in. and under	22.50 to 23.00
Cast iron borings	13.25 to 13.75
Short shov. turn.	14.00 to 14.50
Machine shop turn.	13.00 to 13.50
Rerolling rails	24.00 to 24.50
Steel rails under 3 ft.	23.00 to 23.50
Steel rails under 2 ft.	23.50 to 24.00
Angle bars steel	22.00 to 22.50
Cast iron carwheels	20.00 to 20.50
Railroad malleable	23.00 to 23.50
Agric. malleable	17.50 to 18.00
	Per Net Ton
Iron car axles	24.50 to 25.00
Steel car axles	24.00 to 24.50
Locomotive tires	18.00 to 18.50
Pipes and flues	13.50 to 14.00
No. 1 machinery cast	17.50 to 18.00
Clean auto. blocks	18.00 to 18.50
No. 1 railroad cast	16.50 to 17.00
No. 1 agric. cast	16.00 to 16.50
Stove plate	12.50 to 13.00
Grate bars	14.00 to 14.50
Brake shoes	14.25 to 14.75

YOUNGSTOWN

Per gross ton delivered to consumer:

No. 1 hvy. mltng. steel	$21.50 to $22.00
No. 2 hvy. mltng. steel	20.50 to 21.00
Low phos. plate	24.00 to 24.50
No. 1 busheling	20.75 to 21.25
Hydraulic bundles	21.00 to 21.50
Machine shop turn.	14.00 to 14.50

CLEVELAND

Per gross ton delivered to consumer:

No. 1 hvy. mltng. steel	$20.50 to $21.00
No. 2 hvy. mltng. steel	19.50 to 20.00
Comp. sheet steel	$20.00 to $20.50
Light bund. stampings	16.50 to 17.00
Drop forge flashings	19.25 to 19.75
Machine shop turn.	12.50 to 13.00
Short shov. turn.	13.00 to 13.50
No. 1 busheling	19.75 to 20.25
Steel axle turnings	20.00 to 20.50
Low phos. billet and bloom crops	25.00 to 25.50
Cast iron borings	14.00 to 14.50
Mixed bor. & turn.	14.00 to 14.50
No. 2 busheling	14.00 to 14.50
No. 1 cupola cast	22.00 to 22.50
Railroad grate bars	15.50 to 16.00
Stove plate	15.50 to 16.00
Rails under 3 ft.	25.50 to 26.00
Rails for rolling	25.00 to 25.50
Railroad malleable	24.50 to 25.00

BUFFALO

Per gross ton delivered to consumer:

No. 1 hvy. mltng. steel	$20.00 to $20.50
No. 2 hvy. mltng. steel	18.00 to 18.50
Scrap rails	21.50 to 22.00
New hvy. b'ndled sheets	18.00 to 18.50
Old hydraul. bundles	16.50 to 17.00
Drop forge flashings	18.00 to 18.50
No. 1 busheling	18.00 to 18.50
Machine shop turn.	13.50 to 14.00
Shov. turnings	14.50 to 15.00
Mixed bor. & turn.	13.50 to 14.00
Cast iron borings	13.50 to 14.00
Knuckles & couplers	24.50 to 25.00
Coil & leaf springs	24.50 to 25.00
Rolled steel wheels	24.50 to 25.00
No. 1 machinery cast.	20.50 to 21.00
No. 1 cupola cast	19.00 to 19.50
Stove plate	17.00 to 17.50
Steel rails under 3 ft.	25.50 to 26.00
Cast iron carwheels	18.50 to 19.50
Railroad malleable	22.50 to 23.50
Low phos. plate	25.00 to 26.00

ST. LOUIS

Dealers' buying prices per gross ton delivered to consumer:

Selected hvy. melting	$17.00 to $17.50
No. 1 hvy. melting	17.25 to 17.75
No. 2 hvy. melting	16.00 to 16.50
No. 1 locomotive tires	20.00 to 20.50
Misc. stand. sec. rails	20.25 to 20.75
Railroad springs	21.50 to 22.00
Bundled sheets	13.00 to 13.50
Cast bor. & turn.	10.00 to 10.50
Machine shop turn.	10.50 to 11.00
Heavy turnings	13.25 to 13.75
Rails for rerolling	22.50 to 23.50
Steel car axles	23.50 to 24.00
No. 1 RR. wrought	15.00 to 15.50
No. 2 RR. wrought	17.00 to 17.50
Steel rails under 3 ft.	22.75 to 23.25
Steel angle bars	20.00 to 20.50
Cast iron carwheels	20.00 to 20.50
No. 1 machinery cast.	19.50 to 20.00
Railroad malleable	19.50 to 20.00
Breakable cast	16.75 to 17.25
Stove plate	13.50 to 14.00
Grate bars	13.50 to 14.00
Brake shoes	14.50 to 15.00

CINCINNATI

Dealers' buying prices per gross ton at yards:

No. 1 hvy. mltng. steel	$16.25 to $17.75
No. 2 hvy. mltng. steel	14.75 to 15.25
Scrap rails for mltng.	21.75 to 22.25
Loose sheet clippings	11.50 to 12.00
Hyd'lic bundled sheets	15.50 to 16.00
Cast iron borings	7.75 to 8.25
Machine shop turn.	8.75 to 9.25
No. 1 busheling	12.25 to 12.75
No. 2 busheling	6.50 to 7.00
Rails for rolling	23.25 to 23.75
No. 1 locomotive tires	18.50 to 19.00
Short rails	23.75 to 24.25
Cast iron carwheels	17.75 to 18.25
No. 1 machinery cast.	20.25 to 20.75
No. 1 railroad cast	18.75 to 19.25
Burnt cast	12.25 to 12.75
Stove plate	12.25 to 12.75
Agricul. malleable	16.75 to 17.25
Railroad malleable	19.75 to 20.25
Mixed hvy. cast	17.50 to 18.00

BIRMINGHAM

Per gross ton delivered to consumer:

No. 1 hvy. melting steel	....	$18.00
No. 2 hvy. melting steel	....	17.00
No. 1 busheling	....	16.00
Scrap steel rails	....	17.00
Steel rails under 3 ft.	....	19.50
Rails for rolling	....	20.00
Long turnings	....	7.50
Cast iron borings	....	8.50
Stove plate	....	11.00
Steel axles	....	18.00
No. 1 RR wrought	....	16.00
No. 1 cast	....	17.00
No. 2 cast	....	13.00
Cast iron carwheels	....	17.00
Steel carwheels	....	18.00

DETROIT

Dealers' buying prices per gross ton, f.o.b. cars:

No. 1 heavy melting	$16.00 to $16.50
No. 2 heavy melting	15.00 to 15.50
Borings and turnings	11.50 to 12.00
Machine shop turnings	11.50 to 12.00
Long turnings	9.50 to 10.00
Short shov. turnings	12.00 to 12.50
No. 1 cast	18.50 to 19.00
Automotive cast	18.50 to 19.00
Hvy. breakable cast	15.00 to 15.50
Stove plate	12.25 to 12.75
Hydraul. Comp. sheets	18.50 to 19.00
New busheling	16.50 to 17.50
Sheet clips	14.50 to 15.00
Flashings	16.00 to 16.50
Low phos. plate	20.00 to 21.00

NEW YORK

Dealers' buying prices per gross ton on cars:

No. 1 hvy. mltng. steel	$16.00 to $16.50
No. 2 hvy. mltng. steel	15.00 to 15.50
Hvy. breakable cast	17.00 to 17.50
No. 1 machinery cast.	18.50 to 19.00
No. 2 cast	15.50 to 16.00
Stove plate	13.00 to 13.50
Steel car axles	20.00 to 21.00
Shafting	20.00 to 20.50
No. 1 RR. wrought	14.50 to 15.50
No. 1 wrought long	13.00 to 13.50
Spec. iron & steel pipe	12.00 to 12.50
Rails for rolling	20.00 to 20.50
Clean steel turnings*	10.00 to 10.50
Cast borings*	9.00 to 9.50
No. 1 blast furnace	9.00 to 9.50
Cast borings (chem.)	10.00 to 11.00
Unprepared yard scrap	8.50 to 9.00
Light iron	6.50 to 7.00

Per gross ton delivered local foundries:

No. 1 machin. cast	$19.00 to $19.50
No. 2 cast	16.00 to 16.50

* $1.50 less for truck loads.

BOSTON

Dealers' buying prices per gross ton, f.o.b. cars:

Breakable cast	$15.25 to $15.50
Machine shop turn.	9.25 to 9.50
Mixed bor. & turn.	7.50 to 8.00
Bun. skeleton long	12.00 to 12.25
Shafting	19.50 to 19.65
Stove plate	12.50 to 12.75
Cast bor. chemical	9.50 to 9.75

Per gross ton delivered consumers' yards:

Textile cast	$19.00 to $21.00
No. 1 machine cast	17.00 to 20.00

Per gross ton delivered dealers' yards:

No. 1 hvy. mltng. steel	$15.25 to $15.75
No. 2 steel	14.25 to 14.50

PACIFIC COAST

Per net ton delivered to consumer:

	San Fran.	Los Ang.	Seattle
No. 1 hvy. mltng. steel	$13.50	to	$14.00
No. 2 hvy. mltng. steel	$13.00		
Bundles	12.00		

CANADA

Dealers' buying prices at these yards, per gross ton:

	Toronto	Montreal
Low phos. steel	$12.50	$12.00
No. 1 hvy. mltng. steel	11.25	10.75
No. 2 hvy. mltng. steel	9.75	9.25
Mixed dealers steel	8.75	8.25
Drop forge flashings	9.75	9.25
New loose clippings	8.75	8.25
Busheling	6.00	5.50
Scrap pipe	7.75	7.25
Steel turnings	7.50	7.00
Cast borings	7.50	7.00
Machinery cast	20.00	19.00
Dealers' cast	19.00	18.00
Stove plate	15.00	14.50

EXPORT

Dealers' buying prices per gross ton:

New York, truck lots, delivered barges	
No. 1 hvy. mltng. steel	$16.00 to $16.50
No. 2 hvy. mltng. steel	15.00 to 15.50
No. 2 cast	15.00 to 15.50
Stove plate	13.00 to 13.50
Boston on cars at Army Base or Mystic Wharf	
No. 1 hvy. mltng. steel	$17.00
No. 2 hvy. mltng. steel	15.50
Rail (scrap)	17.00
Philadelphia, delivered alongside boats, Port Richmond	
No. 1 hvy. mltng. steel	Nominal
No. 2 hvy. mltng. steel	Nominal

Construction Steel

. . .STRUCTURAL STEEL, REINFORCING BARS, PLATES, PILING, ETC.

Fabricated Steel

Lettings slightly higher at 39,925 tons; new projects drop to 7050 tons from 50,000 tons a week ago; plate awards advance to 2360 tons.

AWARDS

NORTH ATLANTIC STATES

9200 Tons, Cheetowaga, N. Y., airplane manufacturing plant for Curtiss Aeroplane Division, Curtiss-Wright Corp., to Bethlehem Steel Co., Lackawanna, N. Y.

2000 Tons, Brooklyn, section 6, Atlantic Avenue improvement for Long Island Railroad Co., to American Bridge Co., Pittsburgh.

1900 Tons, Jamaica, Long Island, grandstand addition for Metropolitan Jockey Club, to American Bridge Co., Pittsburgh.

1100 Tons, New York, apartment house, 37th Street and Madison Avenue, to Harris Structural Steel Co., Plainfield, N. J.

985 Tons, Aqueduct, N. Y., race track grandstand, to Belmont Iron Works, Philadelphia.

800 Tons, Elmira, N. Y., factory and boiler house for Eclipse Machine Co., to American Bridge Co., Pittsburgh.

700 Tons, Philadelphia, extension to artillery case shop, Frankford Arsenal, to Bethlehem Steel Co., Bethlehem, Pa.

500 Tons, Boston, Evans Memorial Hospital addition, to Groisser & Shlager Iron Works, Somerville, Mass., through Sawyer Construction Co., contractor.

440 Tons, Royalston, Mass., Boston & Maine Railroad bridges, to Bethlehem Steel Co., Bethlehem, Pa.

340 Tons, Hamden, Conn., High Standard Mfg. Co. factory, to Bethlehem Fabricators, Inc., Bethlehem, Pa.

270 Tons, New London, Conn., combination repair shop, to Jones & Laughlin Steel Corp., Pittsburgh.

220 Tons, Woodford, Vt., State bridge, to Vermont Structural Co., Burlington, Vt., through Ryan & Densmore Co., Claremont, N. H., contractor.

180 Tons, State of New Jersey, highway bridge, route 39, sections 1B and 10A, to Bethlehem Steel Co., Bethlehem, Pa.

150 Tons, Fulton, N. Y., building for Oswega Falls Corp., to Rogers Structural Steel Co., Corry, Pa.

150 Tons, Berks County, Pa., highway bridge, to Bethlehem Steel Co., Bethlehem, Pa., through Chestnut Hill Contracting Co., Philadelphia.

THE SOUTH

800 Tons, Harriman, Tenn., three bridges for Southern Railway Co., to Bethlehem Steel Co., Bethlehem, Pa.

450 Tons, Mayes County, Okla., bridge, to Capitol Steel & Iron Co., Oklahoma City.

295 Tons, Duncan Field, Tex., warehouse, to Mosher Steel Co., Dallas, Tex.

275 Tons, Nelson-Larue Counties, Ky., State highway bridge, to Midland Structural Steel Co., Cicero, Ill.

265 Tons, Barksdale Field, La., Air Corps shop, to Mississippi Valley Structural Steel Co., St. Louis.

205 Tons, Richmond, Va., two suspension towers, to American Bridge Co., Pittsburgh.

155 Tons, Tampa, Fla., Newberry Store building, to Bushnell-Lyons Co., Tampa, Fla., through Garrick Construction Co.

140 Tons, Louisville, Ky., power house for Louisville Power Co., to Louisville Bridge & Iron Co., Louisville, through Public Utility Engineering & Service Corp.

CENTRAL STATES

8955 Tons, Columbus, Ohio, Curtiss-Wright Corp. factory building, to American Bridge Co., Pittsburgh.

6185 Tons, St. Louis, Curtiss-Wright Corp. factory building, to Mississippi Valley Structural Steel Co., St. Louis.

800 Tons, Canton, Ohio, Timken Roller Bearing Co., expansion, to Joseph T. Ryerson & Son, Inc., Chicago.

520 Tons, Chicago, coal bridge, Loomis Street plant, Commonwealth Edison Co., to Lackawanna Steel Construction Corp., Buffalo, through Robins Conveying Belt Co.

435 Tons, Linn County, Mo., bridge, to Stupp Brothers Bridge & Iron Co., St. Louis.

425 Tons, Rantoul, Ill., two mess halls, Chanute Field, to Duffin Iron Works, Chicago.

300 Tons, Marshalltown, Iowa, diesel engine plant for Iowa Electric Light & Power Co., to Illinois Steel Bridge Co., Jacksonville, Ill.

150 Tons, Shannon County, Mo., bridge, to Reynolds Mfg. Co., Springfield, Mo.

WESTERN STATES

260 Tons, Salinas, Cal., Army hangar, to Herrick Iron Works, Oakland, Cal., through W. W. Petley, Los Angeles, contractor.

240 Tons, Heber, Utah, Duschesne Tunnel supports. (Bureau of Reclamation Specification 926), to Commercial Shearing & Stamping Co., Salt Lake City, through Utah Construction Co., Ogden, Utah, contractor.

125 Tons, Odair, Wash., rotor and stator erection platforms, Grand Coulee power plant (Bureau of Reclamation Specification 1434-D), to American Bridge Co., Pittsburgh.

PENDING STRUCTURAL PROJECTS

NORTH ATLANTIC STATES

675 Tons, Elmira, N. Y., power house for Bendix Aviation Corp.

450 Tons, Quonset Point, R. I., Navy recreational facilities, project No. 13.

250 Tons, Bellevue, D. C., building, Naval Research Laboratory.

225 Tons, Ambridge, Pa., A. M. Byers Co. hot metal building extension.

200 Tons, Sodus Point, N. Y., coaling pier for Pennsylvania Railroad.

190 Tons, Snyder County, Pa., highway bridge.

165 Tons, Bendix, N. J., building for Air Associates, Inc.

150 Tons, West Paterson, N. J., building for Sisters of Immaculate Conception.

150 Tons, Danville, Pa., manufacturing building.

120 Tons, Franklin County, Pa., highway bridge.

120 Tons, Binghamton, N. Y., State railroad trestle.

115 Tons, Philadelphia, storage building for Frankford Arsenal.

110 Tons, Sayreville, N. J., coal bunker for Jersey Central Power & Light Co.

110 Tons, Buffalo, storage plant for Dow & Co., Inc.

SOUTHWEST

550 Tons, Espanola, N. M., State bridge over Rio Grande River, FAP-65 (3).

CENTRAL STATES

5420 Tons, Jefferson Barracks, Mo., bridge across Mississippi River; Massman Construction Co., general contractor.

950 Tons, Lima, Ohio, building for Lima Locomotive Works.

600 Tons, Cincinnati, freight house switching track repairs for Chesapeake & Ohio Railroad.

425 Tons, Newark, Ohio, warehouse for Owens-Corning Glass Corp.

175 Tons, Cincinnati, building No. 18 for Hilton-Davis Chemical Co.

140 Tons, Detroit, addition to gear and axle plant No. 4, Chevrolet Motor Co.

125 Tons, St. Joseph, Mich., service building for 1900 Corp.

WESTERN STATES

612 Tons, Oregon and Washington points, Bonneville Power Administration (Invitation 1464); bids in.

338 Tons, Bakersfield, Cal., highway bridges; bids Nov. 13.

105 Tons, Provo, Utah, State bridge over Provo River.

FABRICATED PLATES

AWARDS

1590 Tons, New York, 730 pieces of 30-in. outside diameter pipe, to American Rolling Mill Co., Middletown, Ohio.

Weekly Bookings of Construction Steel

Week Ended ——→	Oct. 29, 1940	Oct. 22, 1940	Oct. 1, 1940	Oct. 31, 1939	Year to Date 1940	Year to Date 1939
Fabricated structural steel awards	39,925	39,050	56,500	22,600	953,810	797,325
Fabricated plate awards	2,360	900	1,215	11,460	125,930	136,205
Steel sheet piling awards	1,435	2,735	22,225	1,270	65,005	71,095
Reinforcing bar awards	8,950	14,100	5,250	16,100	397,310	397,975
Total Letting of Construction Steel	52,670	56,785	85,190	51,430	1,542,055	1,402,600

300 Tons, Cherokee Dam, Tenn., sluice bars for TVA, to Bethlehem Steel Co., Bethlehem, Pa.

150 Tons, Seattle, 51½-in. pipe for city, to Puget Sound Machinery Depot, Seattle.

120 Tons, St. Louis, 30-in. outside diameter pipe, to American Rolling Mill Co., Middletown, Ohio.

SHEET PILING

AWARDS

1275 Tons, Caddoa, Colo., John Martin Dam (Caddoa Dam), to Carnegie-Illinois Steel Corp., Pittsburgh, through W. E. Callahan, Gunther & Shirley, and Rohl-Connolly Co., Los Angeles, joint contractors.

160 Tons, State of Washington, bridges, to Bethlehem Steel Co., Bethlehem, Pa., through Angelus Gravel & Supply, contractor.

PENDING PROJECT

338 Tons, Santa Barbara, Cal., United States Treasury Department (Specification 176); bids in.

Reinforcing Steel

Awards of 8,950 tons; 4,950 tons in new projects

AWARDS

ATLANTIC STATES

500 Tons, Camp Devens, Mass., barracks, to Concrete Steel Co., Boston.

150 Tons, Philadelphia, Atlantic Refining Co. building, to Bethlehem Steel Co., Bethlehem, Pa., through Lauter Construction Co.

130 Tons, Boston, Evans Memorial Hospital, to Northern Steel Co., through Concrete Steel Co.; Sawyer Construction Co., contractor.

SOUTH AND CENTRAL

707 Tons, Front Royal, Va., State highway project, to Jones & Laughlin Steel Corp., Pittsburgh, through George F. Hazelwood, Cumberland, Md., incorrectly reported last week at 107 tons.

700 Tons, Warren County, Va., three bridges, to Jones & Laughlin Steel Corp., Pittsburgh, through George M. Hazelwood Co., Cumberland, Md., contractor.

200 Tons, Chicago, Sherwin-Williams Paint Co. warehouse, to Calumet Steel Co., through W. E. O'Neil, contractor.

195 Tons, Washington, Marion and Greenup Counties, Ky., two State highway projects, to Truscon Steel Co., Youngstown, through Nalley & Mudd.

170 Tons, Lincoln, Neb., Northeast School, to Bethlehem Steel Co., Bethlehem, Pa.

168 Tons, Washington County, Kan., project, to Sheffield Steel Corp., Kansas City, Mo.

130 Tons, Wabaunsee, Kan., paving, to Laclede Steel Co., St. Louis.

125 Tons, Saginaw, Mich., Chevrolet service parts building, to Truscon Steel Co., Youngstown, through O. W. Burke Co., contractor.

125 Tons, State of Indiana, mesh for highway project R-2037, to Truscon Steel Co., Youngstown, through Roger Daoust.

124 Tons, Charleston, Ind., chimney, Indiana Ordnance, to Laclede Steel Co., St. Louis.

113 Tons, Chicago, Commonwealth Edison Co., to Joseph T. Ryerson & Son., Inc., Chicago.

107 Tons, Riley County, Kan., project, to Laclede Steel Co., St. Louis, Mo.

WESTERN STATES

2325 Tons, Caddoa, Colo., John Martin Dam (Caddoa Dam), to Colorado Fuel & Iron Corp., Denver, through W. E. Callahan, Gunther & Shirley, and Rohl-Connolly Co., Los Angeles, joint contractors.

1340 Tons, Hawthorne, Nev., Navy Ammunition Depot (Specification 9900), to Columbia Steel Co., San Francisco, through William P. Neil, Los Angeles, contractor. Tonnage includes 200 tons of mesh.

1000 Tons, Oakland, Cal., Peralta Villa housing project, to Herrick Iron Works, Oakland, Cal., through Monson Brothers, San Francisco, contractors.

205 Tons, San Luis Obispo, Cal., San Luis Obispo Creek highway bridge, to San Jose Steel Co., San Jose, Cal., through Dan Caputo, San Jose, contractor.

203 Tons, Redwood City, Cal., road work, to Truscon Steel Co., San Francisco, through Piazza & Huntley, and Trewitt, Shields & Fisher, Fresno, Cal., contractors.

179 Tons, San Juan County, N. M., highway work on Farmington-Bloomfield Road, to Rio Grande Steel Products Co., through Sharp & Fellows Construction Co., Los Angeles, contractor.

148 Tons, Pateros, Wash., Columbia Basin project (Bureau of Reclamation Invitation 38,492-A), to Bethlehem Steel Co., San Francisco.

PENDING REINFORCING BAR PROJECTS

ATLANTIC STATES

2500 Tons, Hartford, Conn., unit No. 4 housing project.

304 Tons, Clearfield County, Pa., State highway project R-59, section 10.

140 Tons, Lawrenceville, N. J., school.

108 Tons, Allegheny County, Pa., State highway project, R-228, section 10.

100 Tons, Kittery, Me., housing project, mesh and bars.

100 Tons, Fort Ethan Allen, Vt., barracks.

100 Tons, Concord, N. H., Farmers Exchange building.

SOUTH AND CENTRAL

424 Tons, Jefferson Barracks, Mo., bridge across Mississippi River; Massman Construction Co., general contractor.

365 Tons, Rutledge, Tex., Marshall Ford Dam (Bureau of Reclamation Invitation B-46,969-A); bids Nov. 1.

200 Tons, Great Lakes, Ill., Navy barracks.

102 Tons, Columbus, Ohio, bars and mesh for Lincoln Park housing project; bids taken.

100 Tons, Chicago, A. C. Neilson Co. building.

100 Tons, Chillicothe, Ohio, water softening plant.

WESTERN STATES

296 Tons, Bakersfield, Cal., highway bridges; bids Nov. 13.

Cast Iron Pipe

Austin, Minn., will close bids Nov. 5 for cast iron pipe, various sizes, for water system. Board of Water, Electric, Gas and Power Commissioners, George E. Anderson, president, in charge.

White River, S. D., plans pipe lines for water system; also other waterworks installation, including elevated steel tank and tower and pumping station. Dakota Engineering Co., Mitchell, S. D., is consulting engineer.

Shelton, Wash., plans about 5000 ft. of 8-in., 7000 ft. of 6-in., and 4000 ft. of 4-in. pipe for water system; also deep-well pumping unit and auxiliary equipment. Special election is scheduled to be held in December to approve bond issue for project. Burwell Banta is city engineer.

Webster City, Wis., will vote on extensions and improvements in water system at general election, Nov. 5, including pipe lines and other waterworks installation. Cost about $90,000. Financing is being arranged through Federal aid. General Engineering Co., Portage, Wis., is consulting engineer.

Fairhaven, Mass., plans pipe line extensions in water system and other waterworks installation. Cost about $119,000. F. A. Barbour, Tremont Building, Boston, is consulting engineer.

East Pittsford Water District, Pittsford, N. Y., plans extensions in water system, totaling close to three miles of new mains. Proposed to carry out work early next year. William S. Lozier, Inc., 10 Gibbs Street, Rochester, N. Y., is consulting engineer.

Republic, Ohio, plans pipe lines for water system; also elevated steel tank and tower, pumping station and other waterworks equipment. Bond issue is being sold. Champe, Finkbeiner & Associates, Inc., Nicholas Building, Toledo, Ohio, is consulting engineer.

Monroe, Wash., plans pipe lines for water system and other waterworks installation. Also new sewage system. Surveys and estimates of cost are being made. Parker & Hill, Smith Tower Building, Seattle, are consulting engineers.

Los Angeles Department of Water and Power has awarded 2625 tons of cast iron pipe under Specification 3530 as follows: 1115 tons of 6 and 12-in. to United States Pipe & Foundry Co., San Francisco; 846 tons of 8 and 12-in. to American Cast Iron Pipe Co., Los Angeles; 664 tons of 8-in. to National Cast Iron Pipe Co., Los Angeles.

Fort Worth, Tex., plans about 22,500 ft. of 6-in. pipe for extensions in water system. Financing is being arranged through Federal aid and work is scheduled to begin soon.

Niagara, Wis., plans pipe line extensions and replacements in water system and other waterworks installation. Cost about $55,000. Project will be placed before voters for ratification at general election, Nov. 5.

Omaha, Tex., plans pipe lines for water system and other waterworks installation, including 100,000-gal. elevated steel tank on 75-ft. tower. Cost about $40,000. Freese & Nichols, Capps Building, Fort Worth, Tex., are consulting engineers.

Pipe Lines

Ontario Oil Co., Ltd., National Bank of Commerce Building, San Antonio, Tex., Bert Blair, engineer in charge, plans welded steel pipe line at McAllen, Tex., and vicinity, passing through city for connection with main oil transmission line.

Southern Pipe Line Co., Corpus Christi, Tex., plans 6 and 4-in. welded steel pipe line in oil field in Jim Wells County, to connection with main pipe line, about nine and one-half miles, for crude oil transmission.

Pan-American Pipe Line Co., Texas City, Tex., plans new 10-in. pipe line from oil field in east Texas to Douglass, about 58 miles, and from that point, a 12-in. pipe line to Sinco, near Houston, Tex., about 135 miles, for crude oil transmission to company refinery at latter place. Proposed to use cast iron pressure pipe, welded-joint. Also will build new 8-in. welded pipe line from Cayuga oil field, Anderson County, Tex., to Douglass, about 67 miles, for crude oil transmission, connecting with main pipe line from east Texas field, noted. Several main pumping stations will be built in Cayuga and east Texas oil fields, as well as three intermediate pumping stations for booster service along route. New line will have capacity of over 40,000 bbl. per day. Cost in excess of $1,000,000. Work will be carried out by company forces.

General Purchasing Officer, Panama Canal, Washington, asks bids until Nov. 6 for 4500 ft. of 1½ to 4-in. galvanized steel pipe; also flanges, pipe fittings, etc. (Schedule 4465); until Nov. 4 for 2450 ft. of 16-in. spiral welded steel pipe (Schedule 4468).

Magnolia Pipe Line Co., Magnolia Building, Dallas, Tex., an interest of Magnolia Petroleum Co., same address, has let contract to T. R. Jones, Inc., same address, for new 8-in. cast iron pressure, welded-joint pipe line from Archer oil field, Clay County, Tex., to pumping station at Ringgold, Tex., for crude oil transmission. Connection will be made with main pipe system at latter point. Cost close to $100,000.

Prices of Finished Iron and Steel...

Steel prices on these pages are f.o.b. basing points (in cents per lb.) unless otherwise indicated. On some products either quantity deductions or quantity extras apply. In many cases gage, width, cutting, physical, chemical extras, etc., apply to the base price. Actual realized prices to the mill, therefore, are affected by extras, deductions, and in most cases freight absorbed to meet competition.

Basing Point → / Product ↓	Pittsburgh	Chicago	Gary	Cleveland	Birmingham	Buffalo	Youngstown	Sparrows Point	Granite City	Middletown, Ohio	Gulf Ports, Cars	Pacific Ports, Cars	DELIVERED TO Detroit	New York	Philadelphia
SHEETS															
Hot rolled	2.10¢	2.10¢	2.10¢	2.10¢	2.10¢	2.10¢	2.10¢	2.10¢	2.20¢	2.10¢		2.65¢	2.20¢	2.34¢	2.27¢
Cold rolled[1]	3.05¢	3.05¢	3.05¢	3.05¢		3.05¢	3.05¢		3.15¢	3.05¢		3.70¢	3.15¢	3.39¢	3.37¢
Galvanized (24 ga.)	3.50¢	3.50¢	3.50¢		3.50¢	3.50¢	3.50¢	3.50¢	3.60¢	3.50¢		4.05¢		3.74¢	3.67¢
Enameling (20 ga.)	3.35¢	3.35¢	3.35¢	3.35¢			3.35¢		3.45¢	3.35¢		4.00¢	3.45¢	3.71¢	
Long ternes[2]	3.80¢		3.80¢									4.55¢			
Wrought iron	4.75¢														
STRIP															
Hot rolled[3]	2.10¢	2.10¢	2.10¢	2.10¢	2.10¢		2.10¢			2.10¢		2.75¢	2.20¢		
Cold rolled[4]	2.80¢	2.90¢		2.80¢			2.80¢	(Worcester = 3.00¢)					2.90¢		
Cooperage stock	2.20¢	2.20¢			2.20¢		2.20¢								
Commodity C-R	2.95¢			2.95¢			2.95¢	(Worcester = 3.35¢)					3.05¢		
TIN PLATE Standard cokes (Per 100-lb. base box)	$5.00	$5.00	$5.00						$5.10						
BLACK PLATE 29 gage[5]	3.05¢	3.05¢	3.05¢						3.15¢			4.05¢ [10]			
TERNES, M'FG. Special coated (Per base box)	$4.30		$4.30						$4.40						
BARS															
Carbon steel	2.15¢	2.15¢	2.15¢	2.15¢	2.15¢	2.15¢		(Duluth = 2.25¢)			2.50¢	2.80¢	2.25¢	2.49¢	2.47¢
Rail steel[6]	2.05¢	2.05¢	2.05¢	2.05¢	2.05¢	2.05¢					2.40¢	2.70¢			
Reinforcing (billet)[7]	2.15¢	2.15¢	2.15¢	2.15¢	2.15¢	2.15¢	2.15¢	2.15¢			2.50¢	2.55¢	2.25¢		
Reinforcing (rail)[7]	2.05¢	2.05¢	2.05¢	2.05¢	2.05¢	2.05¢	2.05¢				2.40¢	2.45¢	2.15¢		
Cold finished[8]	2.65¢	2.65¢	2.65¢	2.65¢		2.65¢							2.70¢		
PLATES															
Carbon steel	2.10¢	2.10¢	2.10¢	2.10¢	2.10¢		2.10¢	2.10¢	(Coatesville and Claymont = 2.10¢)		2.45¢	2.65¢		2.29¢	2.15¢
Wrought iron	3.80¢														
Floor plates	3.35¢	3.35¢									3.70¢	4.00¢		3.71¢	
Alloy	3.50¢	3.50¢			(Coatesville = 3.50¢)										
SHAPES															
Structural	2.10¢	2.10¢	2.10¢		2.10¢	2.10¢		(Bethlehem = 2.10¢)			2.45¢	2.75¢		2.27¢	2.215¢
SPRING STEEL C-R															
0.26 to 0.50 Carbon	2.80¢			2.80¢			(Worcester = 3.00¢)								
0.51 to 0.75 Carbon	4.30¢			4.30¢			(Worcester = 4.50¢)								
0.76 to 1.00 Carbon	6.15¢			6.15¢			(Worcester = 6.35¢)								
1.01 to 1.25 Carbon	8.35¢			8.35¢			(Worcester = 8.55¢)								
WIRE[9]															
Bright	2.60¢	2.60¢		2.60¢	2.60¢		(Worcester = 2.70¢)								
Galvanized	2.60¢	2.60¢		2.60¢	2.60¢		(Worcester = 2.70¢)								
Spring	3.20¢	3.20¢		3.20¢			(Worcester = 3.30¢)								
PILING															
Steel sheet	2.40¢	2.40¢				2.40¢					2.85¢	2.95¢			
IRON BARS															
Common		2.25¢			(Terre Haute, Ind. = 2.15¢)										
Refined	3.75¢														
Wrought	4.40¢														

[1] Mill run sheets are 10c. per 100 lb. less than base; and primes only, 25c. above base. [2] Unassorted 8-lb. coating. [3] Widths up to 12 in. [4] Carbon 0.25 per cent and less. [5] Applies to 29 gage within certain width and length limitations. [6] For merchant trade. [7] Straight lengths as quoted by distributers. [8] Also shafting. For quantities of 20,000 to 39,999 lb. [9] Carload lots to manufacturing trade. [10] Boxed.

SEMI-FINISHED STEEL

Billets, Blooms and Slabs

Pittsburgh, Chicago, Gary, Cleveland, Youngstown, Buffalo, Birmingham, Sparrows Point (Rerolling only). Prices delivered Detroit are $2 higher f.o.b. Duluth, billets only, $2 higher.

	Per Gross Ton
Rerolling	$34.00
Forging quality	40.00

Shell Steel

Basic open hearth shell steel f.o.b. Pittsburgh and Chicago.

	Per Gross Ton
3 in. to 12 in.	$52.00
12 in. to 18 in.	54.00
18 in. and over	56.00

Note: The above base prices apply on lots of 1000 tons of a size and section to which are to be added extras for chemical requirements, cutting to length, or quantity. This type of steel is for hot rolled sections used for the forging of shells and includes rounds, round squares, and special sections.

Sheet Bars

Pittsburgh, Chicago, Cleveland, Youngstown, Buffalo, Canton, Sparrows Point, Md.

	Per Gross Ton
Open hearth or bessemer	$34.00

Skelp

Pittsburgh, Chicago, Youngstown, Coatesville, Pa., Sparrows Point, Md.

	Per Lb.
Grooved, universal and sheared	1.90c.

Wire Rods

(No. 5 to 9/32 in.)	*Per Lb.*
Pittsburgh, Chicago, Cleveland	2.00c.
Worcester, Mass.	2.10c.
Birmingham	2.00c.
San Francisco	2.50c.
Galveston	2.25c.

9/32 in. to 4/64 in., $3 a net ton higher. Quantity extras apply.

ROOFING TERNE PLATE

(F.o.b. Pittsburgh; Package, 112 Sheets)

	20x14 in.	20x28 in.
8-lb. coating I.C.	$6.00	$12.00
15-lb. coating I.C.	7.00	14.00
20-lb. coating I.C.	7.50	15.00
25-lb. coating I.C.	8.00	16.00
30-lb. coating I.C.	8.63	17.25
40-lb. coating I.C.	9.75	19.50

WIRE PRODUCTS

(To the Trade, f.o.b. Pittsburgh, Chicago, Cleveland, Birmingham)

	Base per Keg
Standard wire nails	$2.55
Coated nails	2.55
Cut nails, carloads	3.85
	Base per 100 Lb.
Annealed fence wire	$3.05
	Base Column
Woven wire fence*	67
Fence posts (carloads)	69
Single loop bale ties	56
Galvanized barbed wire†	70
Twisted barbless wire	70

*15½ gage and heavier. †On 80-rod spools in carload quantities.

Note: Birmingham base same on above items, except spring wire.

BOLTS, NUTS, RIVETS, SET SCREWS

Bolts and Nuts

(F.o.b. Pittsburgh, Cleveland, Birmingham or Chicago)

	Per Cent Off List
Machine and carriage bolts:	
½ in. and smaller by 6 in. and shorter	68
9/16 and ⅝ in. by 6 in. and shorter	66
¾ to 1 in. by 6 in. and shorter	64
1⅛ in. and larger, all lengths	62
All diameters over 6 in. long	62
Lag, all sizes	65
Plow bolts	68½
Hot pressed nuts; c.p.c., t-nuts; square, hex., blank or tapped:	
½ in. and smaller	66
9/16 in. to 1 in. inclusive	63
1⅛ in. to 1½ inclusive	61
1⅝ in. and larger	60

On above items, excepting plow bolts, additional allowance of 10 per cent for full container quantities.

On all of the above items there is an additional 5 per cent allowance for carload shipments.

Semi-fin. hexagon nuts	U.S.S.	S.A.E.
½ in. and smaller	66	70
9/16 to 1 in.	63	65
1⅛ in. through 1½ in.	61	62
1⅝ in. and larger	60	..

In full container lots, 10 per cent additional discount.

Stove bolts, packages, nuts loose 72½ and 10

Stove bolts in packages, with nuts attached 72½

Stove bolts in bulk 82

On stove bolts freight allowed up to 65c. per 100 lb. based on Cleveland, Chicago, New York, lots of 200 lb. or over.

Large Rivets

(½ in. and larger)

	Base per 100 Lb.
F.o.b. Pittsburgh, Cleveland, Chicago, Birmingham	$3.40

Small Rivets

(7/16 in. and smaller)

	Per Cent Off List
F.o.b. Pittsburgh, Cleveland, Chicago, Birmingham	65 and 10

Cap and Set Screws

	Per Cent Off List
Milled hexagon head, cap screws, 1 in. dia. and smaller	50 and 10
Milled headless set screws, cut thread ¼ in. and larger	64
3/16 in. and smaller	73
Upset hex. head cap screws U.S.S. or S.A.E. thread 1 in. and smaller	70
Upset set screws, cup and oval points	75
Milled studs	52

Freight allowed up to 65c. per 100 lb. based on Cleveland, Chicago or New York on lots of 200 lb. or over.

NON-FERROUS PRICES

Cents per lb. for early delivery

	Oct. 23	Oct. 24	Oct. 25	Oct. 26	Oct. 28	Oct. 29
Copper, Electrolytic[1]	12.00	12.00	12.00	12.00	12.00	12.00
Copper Lake	12.00	12.00	12.00	12.00	12.00	12.00
Tin, Straits, New York	51.625	51.625	51.50	....	51.50	51.50
Zinc, East St. Louis[2]	7.25	7.25	7.25	7.25	7.25	7.25
Lead, St. Louis[3]	5.35	5.35	5.35	5.35	5.35	5.35

[1] Mine producers' quotations only, delivered Conn. Valley. Deduct ¼c. for approximate New York delivery price. [2] Add 0.39c. for New York delivery. [3] Add 0.15c. for New York delivery.

Warehouse Products

Cents per lb., Delivered

Tin	New York	Cleveland
Straits pig	52.75	54.50
Copper		
Electro	12.75	14.00
Castings	12.50	13.50
H. R. Sheets*	20.12	20.12
Seamless tubes*	20.62	20.62
Brass		
Yellow, sheets*	18.65	18.65
Yellow, rods*	13.67	13.67
Seamless tubes*	21.40	21.40
Zinc		
Slabs	8.50	8.10
Sheets, No. 9 casks	12.50	14.00
Lead		
American pig	6.50	6.00
Bar	8.20	8.75
Cut sheets	8.50	8.75
Antimony		
Asiatic	16.00	17.00
Aluminum		
Virgin, 99%	20.00	21.00
No. 1 remelt., 98-99%	18.00	18.50
Solder		
½ and ½	31.50	32.25
Babbitt		
Anti-friction grade	23.50	21.75

Old Metals

Cents per lb., New York

Buying prices are paid by dealers for miscellaneous lots from smaller accumulators. Selling prices are those charged to consumers after the metal has been prepared for their use.

Copper	Dealers' Buying Prices	Dealers' Selling Prices
Hvy. crucible	9.625	10.250
Hvy. and wire	8.625	9.025
Light and bottoms	7.625	8.125
Brass		
Heavy	5.50	6.005
Light	4.50	5.250
No. 1 yel. turn.	5.25	6.25
No. 1 red or compo. turnings	8.750	9.250
Hvy. Mach. compo.	9.125	9.50
Lead		
Heavy	4.50	5.00
Aluminum		
Cast	10.00	11.00
Sheet	13.750	14.750
Zinc	4.375	5.125

Miscellaneous Non-Ferrous Prices

ALUMINUM, delivered: virgin, 99 per cent plus, 18c.-19c. a lb.; No. 12 remelt No. 2 standard, 18c.-19c. a lb. NICKEL, electrolytic, 35c.-36c. a lb. base refinery, lots of 2 tons or more. ANTIMONY, prompt: Asiatic, 16.50c. a lb., New York; American, 13c. a lb., f.o.b. smelter. QUICKSILVER, $167-$170 per flask of 76 lb. BRASS INGOTS, commercial 85-5-5-5, 13.25c. a lb.

*These prices, which are also for delivery from Chicago warehouses, are quoted with the following percentages allowed off for extras: on copper sheets, 33⅓; on brass sheets and rods, 40; on brass tubes, 33⅓, and copper tubes, 40.

ALLOY STEEL

Alloy Steel Blooms, Billets and Slabs

Base per gross ton, f.o.b. Pittsburgh, Chicago, Canton, Massillon, Buffalo or Bethlehem.....$54.00

Alloy Steel Bars

Base per pound, f.o.b. Pittsburgh, Chicago, Buffalo, Bethlehem, Massillon or Canton.

Open-hearth grade ..... 2.70c.
Delivered, Detroit ..... 2.80c.

S.A.E. Series Numbers	Alloy Differential, per 100 Lb.
2000 (1.5 Ni)	$0.35
2100 (1.5 Ni)	0.75
2300 (3.5 Ni)	1.70
2500 (5 Ni)	2.55
3100 Ni-Cr	0.70
3200 Ni-Cr	1.35
3300 Ni-Cr	3.80
3400 Ni-Cr	3.20
4100 Cr-Mo (0.15 to 0.25 Mo.)	0.55
4100 Cr-Mo (0.25 to 0.40 Mo.)	0.75
x4340 Cr-Ni-Mo	1.70
4340 Cr-Ni-Mo	1.85
4600 Ni-Mo (0.2-0.3 Mo, 1.5-2 Ni)	1.20
5100 (0.60-0.90 Cr)	0.35
5100 (0.80-1.10 Cr)	0.45
5100 Cr spring steel	0.15
52-100 Cr. (electric furnace)	2.60
6100 Cr-V bar	1.20
6100 Cr-V spring steel	0.85
C-V	0.85

The above differentials are for hot rolled finished products. The differential for most grades in electric furnace steel is 50c. higher. Slabs with a section area of 16 in. and 2½ in. thick or over take the billet base.

Alloy Cold-Finished Bars

Base per pound, f.o.b. Pittsburgh, Chicago, Gary, Cleveland or Buffalo, 3.35c. Delivered Detroit, 3.45c., carlots.

Alloy Steel Plates

Base per lb., f.o.b. Pittsburgh, Chicago and Coatesville.

Open hearth grade.....3.50c.

STAINLESS AND HEAT-RESISTANT ALLOYS

(Base prices, cents per lb., f.o.b. Pittsburgh)

Chromium-Nickel

No.	304	302
Forging billets	21.25c.	20.40c.
Bars	25.00c.	24.00c.
Plates	29.00c.	27.00c.
Structural shapes	25.00c.	24.00c.
Sheets	36.00c.	34.00c.
Hot rolled strip	23.50c.	21.50c.
Cold rolled strip	30.00c.	28.00c.
Drawn wire	25.00c.	24.00c.

Straight-Chromium

No.	410	430	442	446
Bars	18.50c.	19.00c.	22.50c.	27.50c.
Plates	21.50c.	22.00c.	25.50c.	30.50c.
Sheets	26.50c.	29.00c.	32.50c.	36.50c.
H't strip	17.00c.	17.50c.	24.00c.	35.00c.
C'ld st..	22.00c.	22.50c.	32.00c.	52.00c.

TOOL STEEL

(F.o.b. Pittsburgh)

	Base per Lb.
High speed	67c.
High-carbon-chromium	43c.
Oil-hardening	24c.
Special	22c.
Extra	18c.
Regular	14c.

Prices for warehouse distribution to all points on or East of Mississippi River are 2c. a lb. higher. West of Mississipp quotations are 3c. a lb. higher.

ELECTRICAL SHEETS

(F.o.b. Pittsburgh)

	Base per Lb.
Field grade	3.20c.
Armature	3.55c.
Electrical	4.05c.
Motor	4.95c.
Dynamo	5.65c.
Transformer 72	6.15c.
Transformer 65	7.15c.
Transformer 58	7.65c.
Transformer 52	8.45c.

Silicon strip in coils—Sheet price plus silicon sheet extra width extra plus 25c. per 100 lb. for coils. Pacific ports add 70c. a 100 lb.

CAST IRON WATER PIPE

	Per Net Ton
6-in. and larger, del'd Chicago	$54.80
6-in. and larger, del'd New York	52.20
6-in. and larger, Birmingham	46.00
6-in. and larger f.o.b. dock, San Francisco or Los Angeles or Seattle	56.00

Class "A" and gas pipe, $3 extra; 4-in. pipe is $3 a ton above 6-in. Prices shown are for lots of less than 200 tons. For 200 tons and over, 6-in. and larger is $45 at Birmingham and $53.80 delivered Chicago.

SUCCESS STORY

Finishing Costs Cut 60%!

Scratches on formed and drawn stainless steel parts were eliminated when a manufacturer switched from steel forming dies to dies made of AMPCO METAL, Grade 22. There was a clear saving of 60% on finishing costs — greater production — more profit.

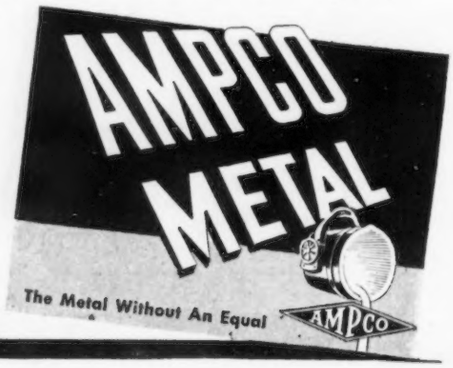
What Can AMPCO Do For YOU?

Study *your* product and production tools. Maybe there's some spot where "*metal failure*" is running up costs, reducing output or hurting the finished product. If so — AMPCO METAL may solve the problem. It's the metal that makes good when all others fail — without equal in its toughness and wearing qualities, its resistance to impact, fatigue and corrosion.

COMPLETE DATA
. . . No Obligation

Tell us what you're up against, and our engineers will supply complete data and recommendations.

AMPCO METAL, INC.
Dept. IR-1031
MILWAUKEE • WISCONSIN



BOILER TUBES

Seamless Steel and Lap Weld Commercial Boiler Tubes and Locomotive Tubes. Minimum Wall.

(Net base prices per 100 ft., f.o.b. Pittsburgh, in carload lots)

	Seamless Cold Drawn	Seamless Hot Rolled	Lap Weld, Hot Rolled
1 in. o.d. 13 B.W.G.	$9.01	$7.82	....
1¼ in. o.d. 13 B.W.G.	10.67	9.26	....
1½ in. o.d. 13 B.W.G.	11.70	10.23	$9.72
1¾ in. o.d. 13 B.W.G.	13.42	11.64	11.06
2 in. o.d. 13 B.W.G.	15.03	13.04	12.38
2¼ in. o.d. 13 B.W.G.	16.76	14.54	13.79
2¼ in. o.d. 12 B.W.G.	18.45	16.01	15.16
2½ in. o.d. 12 B.W.G.	20.21	17.54	16.58
2¾ in. o.d. 12 B.W.G.	21.42	18.59	17.54
3 in. o.d. 12 B.W.G.	22.48	19.50	18.35
3½ in. o.d. 11 B.W.G.	28.37	24.62	23.15
4 in. o.d. 10 B.W.G.	35.20	30.54	28.66
4½ in. o.d. 10 B.W.G.	43.04	37.35	35.22
5 in. o.d. 9 B.W.G.	54.01	46.87	44.25
6 in. o.d. 7 B.W.G.	82.93	71.96	68.14

Extas for less carload quantities:

40,000 lb. or ft. over ..... Base
30,000 lb. or ft. to 39,999 lb. or ft. 5%
20,000 lb. or ft. to 29,999 lb. or ft. 10%
10,000 lb. or ft. to 19,999 lb. or ft. 20%
5,000 lb. or ft. to 9,999 lb. or ft. 30%
2,000 lb. or ft. to 4,999 lb. or ft. 45%
Under 2,000 lb. or ft. 65%

STEEL AND WROUGHT IRON PIPE AND TUBING

Welded Pipe

Base Discounts, f.o.b. Pittsburgh District and Lorain, Ohio, Mills

(F.o.b. Pittsburgh only on wrought iron pipe)

Base Price=$200 Per Net Ton

Butt Weld

Steel	Black	Galv.
⅛ in.	56	36
¼ to ⅜ in.	59	43½
½ in.	63½	54
¾ in.	66½	58
1 to 3 in.	68½	60½

Wrought Iron	Black	Galv.
¼ and ⅜ in.	+9	+10
½ in.	24	6½
¾ in.	30	13
1 and 1¼ in.	34	19
1½ in.	38	21½
2 in.	37½	21

Lap Weld

Steel		
2 in.	61	52½
2½ and 3 in.	64	55½
3½ to 6 in.	66	57¼
7 and 8 in.	65	55½
9 and 10 in.	64½	55
11 and 12 in.	63½	54

Wrought Iron		
2 in.	30½	15
2½ to 3½ in.	31½	17½
4 in.	33½	21
4½ to 8 in.	32½	20
9 to 12 in.	28½	15

Butt weld, extra strong, plain ends

Steel	Black	Galv.
⅛ in.	54½	41½
¼ to ⅜ in.	56½	45½
½ in.	61½	53½
¾ in.	65½	57½
1 to 3 in.	67	60

Wrought Iron		
¼ and ⅜ in.	+10	+43
½ in.	25	9
¾ in.	31	15
1 to 2 in.	38	22½

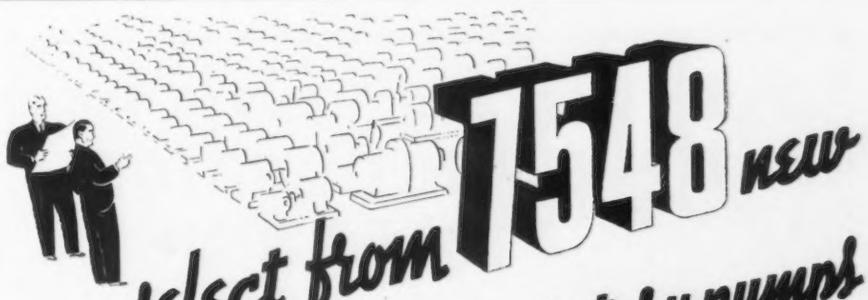
Lap weld, extra strong, plain ends

Steel		
2 in.	59	51½
2½ and 3 in.	63	55½
3½ to 6 in.	66½	59
7 and 8 in.	65½	56
9 and 10 in.	64½	55
11 and 12 in.	63½	54

Wrought Iron		
2 in.	33½	18½
2½ to 4 in.	39	25½
4½ to 6 in.	37½	24
7 and 8 in.	38½	24½
9 to 12 in.	32	20½

On butt weld and lap weld steel pipe jobbers are granted a discount of 5%. On less-than-carload shipments prices are determined by adding 25 and 30% and the carload freight rate to the base card.

F.o.b. Gary prices are two points lower discount or $4 a ton higher than Pittsburgh or Lorain on lap weld and one point lower discount, or $2 a ton higher, on all butt weld 8 in. and smaller.



select from 7548 new ROPER rotary pumps

Roper offers you 8 series of pumps with capacities ranging from 1 to 1000 gallons per minute . . . pressures up to 1000 pounds per square inch . . . speeds up to 1800 RPM . . . 21 different drives and mountings . . . a pump designed to meet your particular requirements with the highest degree of efficiency.

Send us your requirements. We'll send you detailed information on a new ROPER "hydraulically balanced" PUMP to do the job.

HYDRAULICALLY BALANCED

Write for catalog 932 or see our catalog in Sweet's.

GEO. D. ROPER CORP.
Rockford, Illinois

• PERFECT HYDRAULIC BALANCE makes Roper Pumps run smoother, quieter and last longer because internal pressure is equalized at all points.

• CHOICE OF PUMPING GEARS — spiral, spur or herringbone.

• BEARINGS FOR ALL DUTIES — sleeve or roller designed to endure maximum loads.

• BUILT-IN RELIEF VALVE is of sleeve type design—cannot chatter—absolutely leak proof.

• FOUR OPENINGS — permit eight different piping combinations.

ROPER Rotary PUMPS
DEPENDABLE - SINCE 1857

ORES

Lake Superior Ores

Delivered Lower Lake Ports

Per Gross Ton

Old range, bassemer, 51.50%..	$4.75
Old range, non-bessemer,51.50%	4.60
Mesaba, bessemer, 51.50%....	4.60
Mesaba, non-bessemer, 51.50%.	4.45
High phosphorus, 51.50%.....	4.35

Foreign Ores*

C.i.f. Philadelphia or Baltimore, Exclusive of Duty

Per Unit

Algerian, low P, Cu free, dry, 55 to 58% Fe	12c.
Caucasian, washed, 52% Mn	60c.
African, Indian, 44 to 48% Mn	51c.
African, Indian, 49 to 51% Mn	56c.
Brazilian, 46 to 48% Mn	53c.
Cuban, del'd, duty free, 51% Mn	72c.

Per Short Ton Unit

Tungsten, Chinese, Wolframite, duty paid, delivered	Nom.
Tungsten, domestic scheelite, delivered	Nom.
Chrome ore, lump c.i.f. Atlantic Seaboard, per gross ton: South African (low grade)	Nom.
Rhodesian, 45%	$23.50
Rhodesian, 48%	27.50

RAILS, TRACK SUPPLIES

F.o.b. Mill

Standard rails, heavier than 60 lb., gross ton	$40.00
Angle bars, 100 lb.	2.70

F.o.b. Basing Points

Light rails (from billets), gross ton	$40.00
Light rails (from rail steel), gross ton	39.00

Base per Lb.

Cut spikes	3.00c.
Screw spikes	4.55c.
Tie plates, steel	2.15c.
Tie plates, Pacific Coast	2.30c.
Track bolts, steam railroads	4.15c.
Track bolts, discount to jobbers all sizes (per 100 counts)	65-5

Basing points, light rails—Pittsburgh, Chicago, Birmingham; spikes and tie plates—Pittsburgh, Chicago, Portsmouth, Ohio, Weirton, W. Va., St. Louis, Kansas City, Minneaqua, Colo., Birmingham and Pacific Coast ports; tie plates alone—Steelton, Pa., Buffalo; spikes alone—Youngstown, Lebanon, Pa., Richmond, Va.

FLUORSPAR *Per Net Ton*

Domestic washed gravel, 85-5 f.o.b. Kentucky and Illinois mines, all rail	$19.00
Domestic, f.o.b. Ohio River landing barges	19.00
No. 2 lump, 85-5 f.o.b. Kentucky and Illinois mines	19.00
Foreign, 85% calcium fluoride, not over 5% Si., c.i.f. Atlantic ports, duty paid	Nominal
Domestic No. 1 ground bulk, 96 to 98%, calcium fluoride, not over 2½% silicon, f.o.b. Illinois and Kentucky mines	31.00
As above, in bags, f.o.b. same mines	32.60

REFRACTORIES

Fire Clay Brick *Per 1000 f.o.b. Works*

Super-duty brick, at St. Louis	$60.80
First quality Pennsylvania, Maryland, Kentucky, Missouri and Illinois	47.50
First quality, New Jersey	52.50
Second quality, Pennsylvania, Maryland, Kentucky, Missouri and Illinois	42.75
Second quality, New Jersey	49.00
No. 1 Ohio	39.90
Ground fire clay, per ton	7.10

Silica Brick

Pennsylvania	$47.50
Chicago District	55.10
Birmingham	47.50
Silica cement, net ton (Eastern)	8.55

Chrome Brick *Net per Ton*

Standard f.o.b. Baltimore, Plymouth Meeting and Chester	$50.00
Chemically bonded f.o.b. Baltimore, Plymouth Meeting and Chester, Pa.	50.00

Magnesite Brick

Standard f.o.b. Baltimore and Chester	$72.00
Chemically Bonded, f.o.b. Baltimore	61.00

Grain Magnesite

Imported, f.o.b. Baltimore and Chester, Pa. (in sacks)	(—)*
Domestic, f.o.b. Baltimore and Chester in sacks	$40.00
Domestic, f.o.b. Chewelah, Wash. (in bulk)	22.00

*None available.

Fast, Flexible, Low Cost

PRODUCTION CLEANING with DETREX PROCESSES

Your part in the National Preparedness Program requires "stepped-up" efficiency both on your regular production and on government orders.

Avoid a "bottle-neck" in your cleaning, finishing and inspection departments by consulting Detrex Engineers for approved methods. Follow government specifications in the cleaning of aircraft and automotive engines and parts, propellers, robots, radio equipment, photographic and optical instruments, indicating and control devices, shells and arms, special mechanisms, sheet metal parts, etc.

Detrex Equipment and Materials for: Solvent Degreasing; Alkali, Spirits, and Emulsion Cleaning; Bonderizing, Painting and Baking.

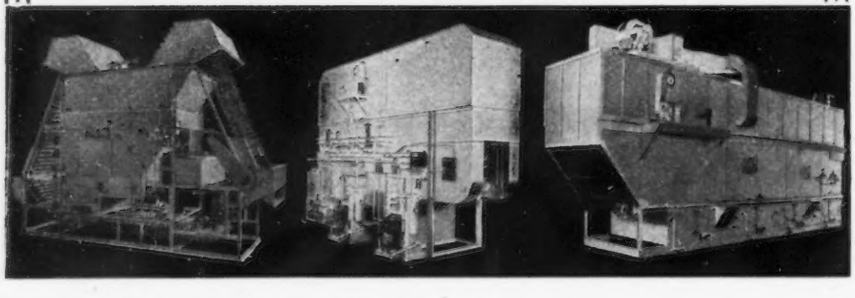
DETROIT REX PRODUCTS COMPANY

Engineered Solvent Degreasing and Alkali Cleaning

13015 Hillview Ave. • Detroit, Mich.

Branch Offices in Principal Cities of U. S. A.

In Canada: Canadian Hanson & Van Winkle Co., Ltd., Toronto, Ont.



FERROALLOYS

Ferromanganese

F.o.b. New York, Philadelphia, Baltimore, Mobile or New Orleans.

	Per Gross Ton
Domestic, 80% (carload)	$120.00

Spiegeleisen

	Per Gross Ton Furnace
Domestic, 19 to 21%	$36.00
Domestic, 26 to 28%	49.50

Electric Ferrosilicon

Per Gross Ton, Delivered, Lump Size

50% (carload lots, bulk)	$74.50*
50% (ton lots, packed)	87.00*
75% (carload lots, bulk)	135.00*
75% (ton lots, packed)	151.00*

Bessemer Ferrosilicon

Per Gross Ton, F.o.b. Jackson, Ohio

10.00 to 10.50%	$33.50

For each additional 0.50% silicon up to 12%, 50c. per ton is added. Above 12% add 75c. per ton.

For each unit of manganese over 2% $1 per ton additional.

Base prices at Buffalo are $1.25 a ton higher than at Jackson.

Silvery Iron

Per Gross Ton, F.o.b. Jackson, Ohio

5.00 to 5.50%	$27.50

For each additional 0.5% silicon up to 12%, 50c. a ton is added. Above 12% add 75c. a ton.

The lower all-rail delivered price from Jackson or Buffalo is quoted with freight allowed. Base prices at Buffalo are $1.25 a ton higher than at Jackson.

Manganese, each unit over 2%, $1 a ton additional. Phosphorus 0.75% or over, $1 a ton additional.

Ferrochrome

Per Lb. Contained Cr., Delivered Carlots Lump Size, on Contract

4 to 6% carbon	11.00c.
2% carbon	17.50c.
1% carbon	18.50c.
0.10% carbon	20.50c.
0.06% carbon	21.00c.

Spot prices are ¼c. per lb. of contained chromium higher.

Silico-Manganese

Per Gross Ton, Delivered, Lump Size, Bulk, on Contract

3% carbon	$113.00*
2.50% carbon	118.00*
2% carbon	123.00*
1% carbon	133.00*

Other Ferroalloys

Ferrotungsten, per lb. contained W, del. carload	$2.00
Ferrotungsten, 100 lb. and less	2.25
Ferrovanadium, contract, per lb. contained V., del'd	$2.70 to $2.90†
Ferrocolumbium, per lb. contained columbium, f.o.b. Niagara Falls, N. Y., ton lots	$2.25†
Ferrocarbontitanium, 15 to 18% Ti, 7 to 8% C, f.o.b. furnace, carload and contract, per net ton	$142.50
Ferrocarbontitanium, 17 to 20% Ti, 3 to 5% C, f.o.b. furnace, carload and contract, per net ton	$157.50
Ferrophosphorus, electric or blast furnace material, in carloads, fo.b. Anniston, Ala., for 18%, with $3 unitage, freight equalized with Rockdale, Tenn., per gross ton	58.50
Ferrophosphorus, electrolytic 23-26% in carlots, f.o.b. Monsanto (Siglo), Tenn., 24%, per gross tons, $3 unitage, freight equalized with Nashville	75.00
Ferromolybdenum, per lb. Mo, f.o.b. furnace	95c.
Calcium molybdate, per lb. Mo, f.o.b. furnace	80c.
Molybdenum oxide briquettes 48-52% Mo, per lb. contained Mo, f.o.b. Langeloth, Pa.	80c.

*Spot prices are $5 per ton higher.
†Spot prices are 10c. per lb. of contained element higher.

FUEL OIL

No. 3, f.o.b. Bayonne, N. J.	4.10c.
No. 6, f.o.b. Bayonne, N. J.	2.98c.
No. 5 Bur. Stds., del'd Chicago	3.25c.
No. 6 Bur. Stds., del'd Chicago	2.75c.
No. 3 distillate, del'd Cleveland	5.25c.
No. 4 industrial, del'd Cleveland	5.00c.
No. 5 industrial, del'd Cleveland	4.00c.
No. 6 industrial, del'd Cleveland	3.50c.

To prevent waste of time, talent and film, Hollywood directors call "Cut!" when the scene is playing badly.

And many metal men are finding an easy way to cut excess metal cleaning costs. They use a Wyandotte Solvent Detergent. For cleaning prior to painting, or assembling, and for removing oils anywhere along the line. Wyandotte does a job that means few rejects and low material cost.

Wyandotte Solvent Detergents are used in metal parts washing machines in the ratio of from one gallon in 600 gallons of water to one gallon in 1000 gallons of water—depending on the problem. Your Wyandotte Representative will be glad to demonstrate. Write us.

Wyandotte SERVICE REPRESENTATIVES IN 88 CITIES
THE J·B·FORD SALES CO· WYANDOTTE MICH·

COKE

Per Net Ton

Furnace, f.o.b. Connellsville, prompt ..... $4.50 to $4.75

Foundry, f.o.b. Connellsville, prompt ..... $5.25 to 5.50

F'dry, by-product, Chicago.... 10.50

F'dry, by-product, New England 13.00

Foundry, by-product, Newark or Jersey City ..... $11.30 to $11.90

F'dry, by-product, Philadelphia 11.13

F'dry, by-product, Cleveland... 11.55

F'dry, by-product, Cincinnati... 11.00

Foundry, Birmingham 7.50

F'dry, by-product, St. Louis $10.75 to $11.00

Foundry, from Birmingham, f.o.b. cars dock Pacific ports..... $14.75

BRITISH

British

Per Gross Ton, f.o.b. United Kingdom Ports

Ferromanganese, export. £17 18s.

Tin plate, per base box. 32s. to 33s.

Steel bars, open hearth £13 9s.

Beams, open hearth.... £12 2s. 6d.

Channels, open hearth.. £12 2s. 6d.

Angles, open hearth.... £12 2s. 6d.

Black sheets, No. 24, gage £18 17s. 6d. max.*; £18 17s. 6d. min.**

Galvanized sheets, No. 24 gage £19 10s. max.*; £19 10s. min.**

*Empire markets only.
**Other than Empire markets.

PIG IRON (Per Gross Ton)

Prices delivered various consuming points indicated by bold italics

	No. 2 Foundry	Basic	Bessemer	Malleable	Low Phos.
Boston	***$24.50***	***$24.00***	***$25.50***	***$25.00***	.....
Brooklyn	***26.50***	.....	.....	***27.00***	.....
Jersey City	***25.53***	***25.03***	***26.53***	***26.03***	.....
Philadelphia	***24.84***	***24.34***	***25.84***	***25.34***	.....
Bethlehem, Pa.	$24.00	$23.50	$25.00	$24.50	.....
Everett, Mass.	24.00	23.50	25.00	24.50	.....
Swedeland, Pa.	24.00	23.50	25.00	24.50	.....
Steelton, Pa.	.....	23.50	.....	.....	28.50
Birdsboro, Pa.	24.00	23.50	25.00	24.50	28.50
Sparrows Point, Md.	24.00	23.50	.....	.....	.....
Erie, Pa.	23.00	22.50	24.00	23.50	.....
Neville Island, Pa.	23.00	22.50	23.50	23 00	.....
Sharpsville, Pa.	23.00	22.50	23.50	23.00	.....
Buffalo	23.00	22.00	24.00	23.50	28.50
Cincinnati	***23.44***	***23.61***	.....	***24.11***	.....
Canton, Ohio	***24.39***	***23.89***	***24.89***	***24.39***	.....
Mansfield, Ohio	***24.94***	***24.44***	***25.44***	***24.94***	.....
St. Louis	***23.50***	***23.02***	.....	.....	.....
Chicago	23.00	22.50	23.50	23.00	.....
Granite City, Ill.	23.00	22.50	23.50	23.00	.....
Cleveland	23.00	22.50	23.50	23.00	.....
Hamilton, Ohio	23.00	22.50	.....	23.00	.....
Toledo	23.00	22.50	23.50	23.00	.....
Youngstown	23.00	22.50	23.50	23.00	.....
Detroit	23.00	22.50	23.50	23.00	.....
St. Paul	***25.63***	.....	***26.13***	***25.63***	.....
Duluth	23.50	.....	24.00	23.50	.....
Birmingham	19.38*	18.00	24.00	.....	.....
Los Angeles, San Francisco and Seattle	***27.50***	.....	.....	.....	.....
Provo, Utah	22.00	.....	.....	.....	.....
Montreal†	27.50	27.50	.....	28.00	.....
Toronto†	25.50	25.50	.....	26.00	.....

GRAY FORGE

Valley or Pittsburgh fce..... $22.50

CHARCOAL

Lake Superior fce..... $27.00
Delivered Chicago 30.34

Base prices are subject to an additional charge for delivery within the switching limits of the respective districts.

*Delivered prices on Southern iron for shipment to Northern points are 38c. a ton below delivered prices from nearest Northern basing point on iron with phosphorus content of 0.70 per cent and over. †On all grades 2.25 per cent silicon and under is base. For each 25 points of silicon over 2.25 per cent an extra of 25c. is charged.

WAREHOUSE PRICES

(Base Prices, Dollars per 100 lb., Delivered Metropolitan Areas)

	Pittsburgh	Chicago	Cleveland	Philadelphia	New York	Detroit	Buffalo	Boston	Birmingham	St. Louis	St. Paul	Milwaukee	Los Angeles
Sheets, hot rolled	$3.15	$3.05	$3.15	$3.35	$3.38	$3.23	$3.05	$3.51	$3.45	$3.18	$3.30	$3.48	$4.30
Sheets, cold rolled	....	4.10	4.05	4.05	4.40	4.30	4.30	4.58	....	4.12	4.35	4.43	6.50
Sheets, galvanized	4.75	4.60	4.42	4.75	4.30	4.64	4.00	4.66	4.75	4.95	4.75	4.98	5.25
Strip, hot rolled	3.40	3.40	3.30	3.75	3.76	3.48*	3.62	3.86	3.70	3.52	3.65	3.73	....
Strip, cold rolled	3.20	3.30	3.20	3.31	3.31	3.20	3.22	3.26	....	3.41	3.83	3.54	....
Plates	3.40	3.55	3.40	3.55	3.76	3.60	3.62	3.85	3.35	3.47	3.80	3.68	4.00
Structural shapes	3.40	3.55	3.58	3.55	3.75	3.65	3.40	3.85	3.55	3.47	3.80	3.68	4.00
Bars, hot rolled	3.35	3.50	3.25	3.85	3.84	3.43	3.35	3.98	3.50	3.62	3.75	3.63	4.15
Bars, cold finished	3.65	3.75	3.75	4.06	4.09	3.80	3.75	4.13	4.43	4.02	4.34	3.88	6.60
Bars, ht. rld. SAE 2300	7.20	7.10	7.55	7.31	7.35	7.42	7.35	7.50	....	7.47	7.45	7.33	9.40
Bars, ht. rld. SAE 3100	5.75	5.65	5.85	5.86	5.90	5.97	5.65	6.05	....	6.02	6.00	5.88	8.55
Bars, cd. drn. SAE 2300	8.15	8.15	8.15	8.56	8.59	8.45	8.40	8.63	....	8.52	8.84	8.38	10.65
Bars, cd. drn. SAE 3100	6.75	6.75	6.75	7.16	7.19	7.05	6.75	7.23	....	7.12	7.44	6.98	9.80

BASE QUANTITIES: Hot rolled sheets, cold rolled sheets, hot rolled strip, plates, shapes and hot rolled bars, 400 to 1999 lb.; galvanized sheets, 150 to 1499 lb.; cold rolled strip, extras apply on all quantities; cold finished bars, 1500 lb. and over; SAE bars, 1000 lb. and over. Exceptions: Chicago, galvanized sheets, 500 to 1499 lb.; Philadelphia, galvanized sheets, one to nine bundles, cold rolled sheets, 1000 to 1999 lb.; Detroit, galvanized sheets, 500 to 1499 lb.; Buffalo, cold rolled sheets, 500 to 1500 lb., galvanized sheets, 450 to 1499 lb.; Boston, cold rolled and galvanized sheets, 450 to 3749 lb.; Birmingham, hot rolled sheets, strip and bars, plates and shapes, 400 to 3999 lb., galvanized sheets, 500 to 1499 lb.; St. Louis, cold rolled sheets, 400 to 1499 lb., galvanized sheets, 500 to 1499 lb.; Milwaukee, cold rolled sheets, 400 to 1499 lb., galvanized sheets, 150 to 499 lb.; New York, hot rolled sheets, 0 to 1999 lb., cold rolled sheets, 400 to 1499 lb.; St. Paul, galvanized and cold rolled sheets, any quantity, hot rolled bars, plates, shapes, hot rolled sheets, 400 to 14,999 lb.; Los Angeles, hot rolled sheets, bars, plates, shapes, cold rolled sheets, 300 to 1999 lb., galvanized sheets, 150 to 1049 lb. Extras for size, quality, etc., apply on above quotations. *12 gage and heavier, $3.23.

Sales Possibilities

. . . CONSTRUCTION, PLANT EXPANSION AND EQUIPMENT BUYING

North Atlantic States

• **Intercontinent Aircraft Corp.,** Bruce D. Leighton, head of Intercontinent Corp., 50 Rockefeller Plaza, New York, airplane exports, president, recently organized under Florida laws with capital of $1,500,000 by Mr. Leighton and associates, has acquired about 100 acres at LeJeune Road and N. W. Thirty-sixth Street, Miami, Fla., for new plant for production of all-metal monoplanes and allied aircraft for military service. It will comprise one-story buildings for foundry, machine shops, metal-working and wood-working shops, paint shop and other departments for parts production and assembling, with power house and mechanical units. Cost close to $700,000 with equipment. Weed & Reeder, 1777 Biscayne Boulevard, Miami, are engineers. Paul R. Scott, an official of Loftin, Calkins, Anderson & Scott, Ingraham Building, Miami, is vice-president; William D. Pawley, 3190 Peachtree Drive, Miami Beach, Fla., is chairman of board.

Phelps-Dodge Copper Products Corp., 40 Wall Street, New York, a subsidiary of Phelps-Dodge Corp., same address, has let general contract to Wigton-Abbott Corp., 60 East Forty-second Street, for two one-story additions to branch plant at Elizabeth, N. J., 100 x 240 ft., and 85 x 105 ft., respectively, for expansion in production, storage and distribution, and for extensions in tube mill. Cost over $125,000 with equipment. Savary & Glaeser, Inc., 102 North Washington Avenue, Dunellen, N. J., is engineer.

Public Works Officer, Navy Yard, Brooklyn, will begin superstructure soon for one-story turret and erection shop, to cost about $3,300,000 with equipment; one-story sub-assembly shop units, cost about $500,000 with equipment, and two-story paint shop, cost $150,000 with equipment. Appropriations have been authorized in amount noted. This is part of general expansion at yard to cost about $12,700,000.

American Brake Shoe & Foundry Co., 230 Park Avenue, New York, has let general contract to Robert Goldie & Co., 19 South LaSalle Street, Chicago, for one and two-story addition, 66 x 116 ft., to plant of American Forge Division, 2621 South Oakley Avenue, Chicago, for expansion in die department, including improvements in present works. Cost over $85,000 with equipment. Benjamin F. Olson, 19 South LaSalle Street, Chicago, is architect.

Continental Can Co., 100 East Forty-second Street, New York, plans one-story addition to branch plant at San Jose, Cal. Cost over $60,000 with equipment.

American Locomotive Co., 30 Church Street, New York, will soon begin superstructure for one-story addition to branch plant at Auburn, N. Y. Seneca Engineering Co., Montour Falls, N. Y., is general contractor.

Commanding Officer, Ordnance Department, Picatinny Arsenal, near Dover, N. J., asks bids until Nov. 4 for 3842 bomb fuzes, and inspection gages for bomb fuze nose (Circular 908).

New York Shipbuilding Corp., Camden, N. J., will carry out expansion for construction of vessels for Federal Government, including extensions in shipways, shops, warehouses and other buildings, and installation of machine and other tools, electric cranes, hoists and other mechanical-handling equipment. Fund of $10,500,000 has been secured through Navy Department for work.

Michael Flynn Mfg. Co., 2263 East Allegheny Avenue, Philadelphia, iron and steel products, has leased about 100,000 sq. ft. in former building of David Lupton Co., Tulip Street and Allegheny Avenue, for expansion.

Lee Tire & Rubber Co., Conshohocken, Pa., automobile tires and tubes, has let general contract to F. R. Heavner Co., Norristown, Pa., for one-story addition. Cost over $50,000 with equipment.

C. Schmidt & Sons, Inc., 127 Edwards Street, Philadelphia, brewer, has let general contract to A. Raymond Raff Co., 1635 West Thompson Street, for one and one-half story addition for mechanical-bottling works. Cost close to $150,000 with equipment.

Walker Brothers, Inc., Conshohocken, Pa., electric products for construction service, will begin superstructure for one and two-story plant, 72 x 250 ft., for which general contract recently was let to Frank G. Stewart Co., 1518 Locust Street, Philadelphia. Cost close to $100,000 with equipment. Ballinger Co., 105 South Twelfth Street, Philadelphia, is architect and engineer.

Scintilla Magneto Co., Sidney, N. Y., Division of Bendix Aviation Corp., New York, magnetos and kindred products and parts, has let general contract to Lewis & Son Co., Bainbridge, N. Y., for one-story addition, about 125 x 900 ft. Cost over $650,000 with equipment.

Oswego Falls Corp., Fulton, N. Y., metal bottle caps, etc., has let general contract to H. K. Ferguson Co., Hanna Building, Cleveland, engineer and contractor for one-story and basement addition, 100 x 135 ft. Cost close to $100,000 with equipment.

Leland-Gifford Co., 1001 Southbridge Street, Worcester, Mass., drilling and tapping machines and parts, has let general contract to Albert J. Daniels, 661 Main Street, Shrewsbury, Mass., for one-story addition, 140 x 200 ft. Cost over $125,000 with equipment.

Bath Iron Works Corp., Bath, Me., will carry out expansion at shipbuilding plant for construction of vessels for Federal Government, including one-story fabricating shop, for which Navy Department, Washington, has authorized appropriation of $1,600,000 for building and equipment.

Hamilton Standard Propeller Division, United Aircraft Corp., East Hartford, Conn., has leased former textile mill of Lorraine Mfg. Co., Pawtucket, Conn., totaling 200,000 sq. ft. of floor space, and will remodel for branch plant for production of propeller blades, parts and assembling. Operations are scheduled to begin early in 1941.

Commanding Officer, Springfield Armory, Springfield, Mass., asks bids until Nov. 8 for 2964 water chests, caliber .50, with hose assembly, and for extra parts (Circular 98).

Crown Cork & Seal Co., Eastern Avenue and Kresson Street, Baltimore, metal bottle caps, capping machines, etc., has asked bids on general contract for one-story addition. Cost over $50,000 with equipment. Lucius R. White, Jr., 10 West Chase Street, is architect.

Bureau of Yards and Docks, Navy Department, Washington, plans one-story tracer-loading building at naval ammunition depot, St. Juliens Creek, Va., cost about $100,000 with equipment; also one-story explosive-loading plant, cost about $200,000 with equipment; one-story storage and distributing building, cost $125,000; one-story powder bag-filling plant, $100,000; and projectile and case-loading equipment and facilities, cost about $250,000. Appropriations have been approved in amounts noted.

Chemical Warfare Service, Edgewood Arsenal, Edgewood, Md., asks bids until Nov. 8 for condensing and refrigeration equipment (Circular 503).

Mead Corp., Heald Division, Lynchburg, Va., paper board products, has let general contract to C. W. Hancock & Sons Co., Allied Arts Building, for one-story addition, 100 x 300 ft., for expansion in laminated board division. Cost close to $100,000 with equipment. Main offices are at Chillicothe, Ohio.

Public Works Officer, Washington Navy Yard, Alexandria, Va., plans one-story addition to torpedo shop. Cost about $145,000 with equipment. Appropriation in that amount has been authorized and work will be carried out soon.

Bureau of Supplies and Accounts, Navy Department, Washington, asks bids until Nov. 5 for brass and copper pipe and tubing (Schedule 3666), propeller shafts (Schedule 3682), gasoline engine-driven centrifugal water pump (Schedule 3719), bending and straightening machine (Schedule 3733), tool forming grinder (Schedule 3713), press brake (Schedule 3732), all motor-driven; carbon and high-speed twist drills (Schedule 3688), electric welding machine (Schedule 3694); until Nov. 8 for an electric furnace (Schedule 3699) for Eastern and Western Navy yards.

Aluminum Co. of America, Inc., Gulf Building, Pittsburgh, has let general contract to Turner Construction Co., 420 Lexington Avenue, New York, for eight-story addition to branch fabricating plant at Edgewater, N. J. Cost over $750,000 with equipment. This is part of general expansion program of company.

Chicago Pneumatic Tool Co., Franklin, Pa., has asked bids on general contract for one-story addition, 60 x 250 ft. Cost close to $100,000 with equipment. Main offices are at 6 East Forty-Fourth Street, New York.

Allegheny Ludlum Steel Corp., Oliver Building, Pittsburgh, has begun work on one-story addition, 50 x 100 ft., to branch plant at Dunkirk, N. Y., for which Meister Construction Co., 12 West Third Street, Dunkirk, is general contractor. Cost close to $50,000 with equipment.

The South

• **Swift & Co.,** Union Stock Yards, Chicago, meat packers, have let general contract to Jiroud Jones Construction Co., Walton Building, Atlanta, Ga., for one-story processing and packing plant at Moultrie, Ga. Cost close to $50,000 with equipment.

Public Works Officer, Naval Air Station, Pensacola, Fla., plans one-story addition to aircraft storage and distributing building. Cost about $150,000 with equipment. Also extensions in power lines and electric power facilities for connection with system of Gulf Power Co., to cost $55,000. Appropriations have been authorized.

State Highway Department, Columbia, S. C., asks bids until Nov. 6 for iron castings, angle iron posts, wire fencing, etc.

Bayonne Steel Barrel Co., Constable Hook, Bayonne, N. J., has begun work on one-story branch plant at Port Arthur, Tex., with main L-shaped unit, 63 x 126 x 275 ft., and auxiliary buildings, and dock, 30 x 70 ft. Thomas Bate & Sons, 1107 Girard Street, Houston, Tex., are general contractors. Cost close to $100,000 with equipment.

Cameron Iron Works, Inc., 711 Milby Street, Houston, Tex., iron and steel products, has let general contract to Brown Construction Co., 2204 Fannin Street, for one-story addition. Cost over $50,000 with equipment.

Reynolds Metals Co., Federal Reserve Bank Building, Richmond, Va., has let general contract to Daniel Construction Co., Anderson, S. C., for new plant near Sheffield, Ala., for production of aluminum ore from bauxite, to include storage and distributing buildings, machine shop, electric power station and other structures. All machinery will be electric-operated and contract has been made with TVA for power supply. Company recently arranged financing in amount of $15,800,000 through RFC for project, initial units to be completed next spring. J. E. Sirrine & Co., Greenville, S. C., are consulting engineers.

Constructing Quartermaster, Fort Knox, Ky.,

has let general contract to Skilken Brothers, Inc., 44 East Broad Street, Columbus, Ohio, for steel hangar at local field, at $266,421 exclusive of equipment.

Commanding Officer, Alabama National Guard, 106th Observation Squadron, 240 Graymont Avenue, N. W., Birmingham, plans new steel hangar at airport, 150 x 180 ft., with shop and reconditioning facilities. Cost close to $175,000. W. C. Douglas, 1842 South Twenty-first Street, is architect; I. E. Morris, Empire Building, is consulting engineer.

Southwest Compressed Tin Co., 3601 Hill Road, Little Rock, Ark., plans new one-story plant at North Little Rock, with installation of hydraulic press, mechanical-handling and other equipment. Cost close to $50,000.

Central States

• **Taylorcraft Aviation Corp.**, Alliance, Ohio, will take bids at once for two-story addition, 100 x 300 ft., for parts production and assembling, with two-story and basement office, 40 x 100 ft. Cost over $200,000 with equipment. Albert Kahn Associated Architects & Engineers, Inc., Detroit, is architect and engineer.

Fulton Foundry & Machine Co., East Seventy-fifth Street and Morgan Avenue, Cleveland, iron castings, machine parts, etc., has let contract to Kilroy Structural Steel Co., 13800 Miles Avenue, for one-story addition, 30 x 140 ft., with extension, 30 x 60 ft., for expansion in foundry. Cost close to $55,000 with equipment.

Timken Roller Bearing Co., Canton, Ohio, has let general contract to Gibbons-Grable Co., Canton, for one-story addition, 220 x 280 ft., to Gambrinus bearing plant. Cost over $200,000 with equipment.

American Steel & Wire Co., Rockefeller Building, Cleveland, has approved plans for three one-story additions to local plant, 80 x 575 ft., for stainless steel strip production; 80 x 120 ft., and 67 x 120 ft., both for storage and distribution. Cost over $600,000 with equipment.

Lucas Machine Tool Co., 523 East Ninety-ninth Street, Cleveland, boring machines, presses, etc., has asked bids on general contract for one-story addition, 45 x 175 ft. Cost close to $100,000 with equipment. H. M. Morse Co., 1500 Superior Avenue, is architect.

American Foundry Equipment Co., South Byrkit Street, Mishawaka, Ind., plans one-story addition, 70 x 256 ft., for assembling service, and one-story office building, 25 x 70 ft. Cost over $150,000 with equipment. Andrew Toth, 1509 North O'Brien Street, South Bend, Ind., is architect.

Board of Public Works, Anderson, Ind., plans expansion and improvements in municipal power plant, including new four-drum, bent-tube type, 1200-hp. steam-generating unit and accessories, superheater, economizer, fly-ash collection system and other equipment. Cost about $300,000. Russell B. Moore & Co., Indiana Pythian Building, Indianapolis, are consulting engineers.

Snyder Tool & Engineering Co., 3400 East Lafayette Street, Detroit, plans one-story addition for increase in present capacity, with installation of two 15-ton traveling cranes, hoists and other mechanical-handling facilities. Company is arranging for stock issue to total about $256,500, considerable part of proceeds to be used for purpose noted.

Saginaw Malleable Iron Division, General Motors Corp., Saginaw, Mich., has let general contract to Spence Brothers, Saginaw, for one-story addition, to be used as an oven building and for annealing service. Cost close to $75,000 with equipment.

City Pattern Works, Inc., 1161 Harper Street, Detroit, metal and wood patterns, will take bids soon on general contract for one-story addition, 110 x 125 ft. Cost over $65,000 with equipment. Norman Krecke, 243 West Congress Street, is architect.

A. C. Spark Plug Division, General Motors Corp., Flint, Mich., has approved plans for three one-story additional buildings at new plant now in course of erection on neighboring site, to provide for entire vacation of present works. Cost over $300,000 with equipment, making cost of entire project close to $1,500,000 with equipment. Vacated plant will be used for production of machine guns for Federal Government, including parts manufacture and assembling.

Advance Aluminum Castings Corp., 2742 West Thirty-sixth Place, Chicago, has asked bids for one-story addition, 85 x 120 ft., for expansion in foundry. Cost over $70,000 with equipment. Kocher & Larson, 506 West Sixty-third Street, are architects.

Continental Dynamo & Motor Co., 2592 Ninth Street, Rockford, Ill., has let general contract to Linden & Sons, Inc., 1102 Tenth Street, for one-story addition, 54 x 140 ft. Cost about $50,000 with equipment. Rollin Wood, Norwood Street and Twenty-fifth Avenue, Melrose Park, Ill., is engineer.

A. O. Smith Corp., Milwaukee, iron and steel products, etc., has let general contract to Wisconsin Bridge & Iron Co., 5023 North Thirty-fifth Street, for one-story addition, 175 x 300 ft., for production of bomb units for Federal Government. Cost over $500,000 with machinery.

Auto Engine Works, Inc., 349 North Hamline Avenue, St. Paul, Minn., gasoline marine engines and parts, has let general contract to Madsen Construction Co., 1790 Lyndale Avenue South, Minneapolis, for one-story addition, 50 x 160 ft. Cost close to $50,000 with equipment.

Public Works Officer, Naval Training Station, Great Lakes, Ill., plans extensions and improvements in power plant, including additional equipment. Cost about $450,000. Appropriation in that amount has been authorized.

Lafayette Steel Corp., 4150 West Forty-second Place, Chicago, has let general contract to Poirot Construction Co., 2001 West Pershing Road, for one-story storage and distributing plant, 100 x 400 ft. Cost over $85,000 with equipment. A. Epstein, 2001 West Pershing Road, is engineer.

Pressed Steel Tank Co., 1445 South Sixty-sixth Street, West Allis, Wis., has let general contract to Wisconsin Bridge & Iron Co., 5023 North Thirty-fifth Street, Milwaukee, for two-story addition, 67 x 80 ft. Cost close to $50,000 with equipment.

Barry-Wehmiller Machinery Co., 4660 West Florissant Street, St. Louis, washers, pasteurizers and other bottling machinery, has let general contract to A. H. Haeseler Building & Contracting Co., 2346 Palm Street, for one-story addition. Cost close to $45,000 with equipment. James L. Harold is company architect.

Safeway Stores, Inc., 2029 Wyandotte Street, Kansas City, Mo., will take bids soon on general contract for one and two-story baking plant, 120 x 140 ft., and 100 x 120 ft. Cost over $65,000 with traveling ovens, conveyors and other mechanical-handling equipment. Charles E. Keyser, 609 Minnesota Avenue, Kansas City, Kan., is architect.

Curtiss-Wright Corp., St. Louis, has leased 35 additional acres at Lambert-St. Louis Airport, and will spend about $8,000,000 to increase size of present plant about six times. New plant is expected to furnish employment for 8000 to 10,000 compared to present employment of 1400.

Western States

• **Lockheed Aircraft Corp.**, 1705 Victory Place, Burbank, Cal., has let general contract to H. W. Baum, 232 South Van Ness Avenue, Los Angeles, for two-story addition, 220 x 257 ft., to be used for a machine shop and allied engineering service. Cost over $650,000 with equipment. John and Donald B. Parkinson, Title Insurance Building, Los Angeles, are architects.

Bureau of Yards and Docks, Navy Department, Washington, asks bids (no closing date stated) for one-story shop at naval dry docks, Hunters Point, Cal., for assembling service (Specifications 10172); also bids (no closing date stated) for buildings at naval supply depot, Oakland, Cal., including one-story transit shed, 39,300 sq. ft. floor space; one and two-story public works shop and fire house; one-story locomotive and crane shed, 8200 sq. ft. floor space and 30 ft. high; garage and service building, 20,300 sq. ft. of floor space (Specifications 10111).

Richfield Oil Corp., 333 Montgomery Street, San Francisco, plans new multi-unit crude oil stabilizing plant in Coles Levee oil field area, near Bakersfield, Cal. Work will be carried out by company forces. Cost close to $350,000 with equipment.

Boeing Aircraft Corp., Marginal Way, Seattle, has let contract to Austin Co., Cleveland, for design and construction of several one-story additions, totaling close to 1,000,000 sq. ft. of floor space for parts production, assembling, testing and other service. Cost over $7,500,000 with equipment.

Bureau of Supplies and Accounts, Navy Department, Washington, asks bids until Nov. 5 for electric cable for Mare Island Navy Yard (Schedule 3671).

San Diego Unified School District, San Diego, Cal., plans two-story vocational school at State and Market Streets, for which bids will be asked soon on general contract. Cost close to $85,000 with equipment. Stanley Burne, San Diego Trust & Savings Building, is engineer.

Canada

• **Canadian Motor Boat Co., Ltd.**, Auger Street, Montreal, has let general contract to Atlas Construction Co., Ltd., 679 Belmont Avenue, for new one-story motor boat works, 50 x 255 ft., with assembling facilities. Cost over $175,000 with equipment. T. Pringle & Son, Ltd., 485 McGill Street, is architect.

Canadian Acme Screw & Gear, Ltd., 207 Weston Road South, Toronto, Ont., screw machine products, gears, etc., is erecting two-story addition, about 43,000 sq. ft. of floor space, for general expansion in production; one-story addition also will be built to heat-treating building. Cost over $100,000 with equipment.

Mayson & Campbell Aviation Co., Ltd., Prince Albert, Sask., has let general contract to National Contracting Co., Ltd., Prince Albert, for one-story addition. Cost close to $65,000 with equipment.

Sangamo Electric Co., Ltd., 183 Geary Avenue, Toronto, plans new works on Eglington Avenue, Leaside, Ont., to cost about $100,000.

Canadian Industries, Ltd., 1135 Beaver Hall Hill, Montreal, Que., has let general contract to Carter-Halls-Aldinger, Ltd., Royal Bank Building, Winnipeg, Man., for new plant in vicinity of Winnipeg for production of munitions for Canadian Department of Munitions and Supply, Ottawa, Ont., comprising group of large one and multi-story units, with power house and other mechanical departments. Cost close to $5,000,000 with machinery.

Gypsum, Lime & Alabastine, Canada, Ltd., 50 Maitland Street, Toronto, Ont., building products, plans one-story addition to plant at Beachville, Ont., with machinery installation to double present capacity. Cost about $100,000 with equipment.

Kelvinator of Canada, Ltd., Dundas Street, East, London, Ont., has let general contract to Hyatt Brothers, Ltd., 288 Egerton Street, for one-story addition, 40 x 150 ft. Cost over $85,000 with equipment.

Department of Munitions & Supply, Ottawa, has awarded contract to General Engineering Co. (Canada) Ltd., 100 Adelaide Street West, Toronto, for erection of ordnance buildings at London, Ont. Estimated cost $350,000.

Lever Brothers, Ltd., 299 Eastern Avenue, Toronto, Ont., has plans for $60,000 plant addition for manufacture of chemicals for war. Ewart & Byam, Excelsion Life Building, Toronto Street, are engineers.

Viceroy Mfg. Co., Ltd., 345 Royce Avenue, Toronto, will build machine shop to cost $30,000. Bennett-Pratt, Ltd., 30 Bloor Street West, have general contract.

Hamilton Gear Co., Ltd., 76 Van Horne Street, Toronto, has let general contract to Bradford & Hoshoe, 1170 Yonge Street, for plant addition, 42 x 250 ft., to cost $50,000 with equipment.

Wallace Barnes Co., Ltd., 274 Sherman Avenue North, Hamilton, Ont., has awarded general contract to W. H. Cooper Construction Co., Ltd., Medical Arts Building, Toronto, for $100,000 plant addition.

Anglo Canadian Wire Rope Co., Ltd., Aberdeen Avenue, Lachine, Que., has let general contract to Foundation Co. of Canada, Ltd., 1538 Sherbrooke Street West, Montreal, for $45,000 plant addition.